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THE FOREST SITUATION IN PIEDMONT VIRGINIA

by

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A FOREST SURVEY PROGRESS REPORT

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PREFACE

Through the McSweeny-McNary Act of 1928, Congress authorized the Secretary of Agriculture to conduct a comprehensive survey of the forest resources of the United States. The Forest Survey was organized by the Forest Service to carry out the provisions of the Act, and each of the 12 Regional Experiment Stations was made responsible for the work in its territory. In the Middle Atlantic States the Forest Survey is an activity of the Appalachian Forest Experiment Station, Asheville, North Carolina.

The work of the Survey is divided into 5 major phases:

1. Inventory. Determination of the extent, location, and condition of forest lands, and the quantity, species, and quality of the timber on these lands.
2. Growth. Determination of the current rate of timber growth.
3. Drain. Determination of the amount of industrial and domestic wood use, and the total loss resulting from fire, insects, disease, suppression, and other causes.
4. Requirements. Determination of the current and probable future requirements for forest products by all classes of consumers.
5. Policies and plans. Analysis of the relation of these findings to one another and to other economic factors as a basis for public and private policies and plans of forest land use and management.

This Forest Survey progress report presents preliminary information on the first three of these phases for the Piedmont 1/district of Virginia, comprising two of the five units into which the State has been divided for survey purposes (units nos. 2 and 3). An attempt is made in this report also to show the historical background of the present use and condition of forest lands, to analyze the significance of the current forest situation, and to point out some desirable objectives in forest-land management. A similar report has been published for the Coastal Plain, and to complete the State one report for the two Mountain units will be released.

Information on the physical forest resources was obtained by a field survey made in the summer of 1940. In all, 12,452 quarter-acre sample plots were established at intervals of one-eighth mile on compass lines 10 miles apart, extending across the Piedmont in a northeast direction. The statistical sample obtained from these plot records forms the basis for all area and volume estimates in this report, except where other sources are directly credited. Because of the method of sampling, small tabular items have the greater probability of error and should be considered as indicating relative magnitude rather than actual values.

Data on consumption of forest products for industrial and domestic purposes were obtained by a canvass of all primary manufacturing plants and a number of representative domestic consumers, made in the first half of 1941.

1/ The Piedmont district about which this report is written does not correspond exactly to the Piedmont physiographic province, which lies between the Blue Ridge and the fall line. The eastern boundary has been located west of the fall line so as to exclude most of the loblolly-pine forest. And all boundaries have been placed arbitrarily on county lines. (See fig. 1.)

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SUMMARY OF FINDINGS

An extensively wooded region, Piedmont Virginia has 6 million acres of forest land out of a total of 10 million acres.

Farm woodlands make up 61 percent of this forest.

Saw-timber stands comprise about half of the forest area; cordwood stands, most of the remainder.

Severe depletion typifies the forest stands. Saw-timber volume aggregates 7.6 billion board feet and averages only 1,310 board feet per acre of forest.

Total volume is 72 million cords. Volume of sound growing stock is 57-1/2 million cords -- less than 10 cords per acre.

Pines, chiefly demanded by forest industry, comprise less than 34 percent of cordwood growing stock. Hardwoods, mostly oaks, comprise 66 percent.

Small, young timber predominates. Nearly three-fourths of growing stock is in trees less than 13 inches in diameter.

Limited urban-industrial development requires the majority of the people to depend upon the depleted soil and forest resources for a meager livelihood. Nearly three-fourths of the population is rural.

Forest industry provided 5-3/4 million man-days of employment in 1940 and accounted for more than a fifth of the entire personnel in agriculture, industry, and business.

Lumbering is the main forest industry, with 1,196 mills producing 383 million board feet of lumber in 1940. Most mills are very small and inefficient.

Making fuel wood is also a major forest industry, providing nearly half of all woods and mill employment.

Industrial drain on saw timber in 1940 was 468 million board feet, as compared with current annual growth of 624 million feet (109 feet per acre of forest).

Industrial drain on all growing stock was 144 million cubic feet; growth was 228 million cubic feet (equivalent to 0.60 cord per acre).

However, serious deficits of growth appear in certain localities, especially in saw-timber stands; and growth typically falls short of drain in softwoods and in large-size trees.

Forest industry contributes about one-tenth of all income received by the people of Piedmont Virginia.

But forests' contribution must be made even greater in the future if the people's income is to reach a reasonable level, for the poverty of agricultural resources requires chief hope to be placed in forest and industrial development.

To increase forest income in the face of present forest deterioration will require a revolution in attitudes toward land management.

Principal needs are to curb forest fires and stop destructive cutting so that the forest can be rebuilt, and to correct wasteful inefficiency in timber marketing and utilization.

Section 1. -- INTRODUCTION

Physical Background

The Piedmont of Virginia, a region of hardwood and pine woodlands, extends through the center of the State, between the continuous hardwood forest of the Blue Ridge on the west and the extensive pine areas of the Coastal Plain on the east. Comprising 35 counties, the district is some 200 miles long and tapers in width from over 150 miles along the North Carolina line to 50 miles at the Maryland border (fig. 1). Its land area is a little more than 10 million acres -- two-fifths of Virginia's entire land area -- with nearly 6 million acres in forest.

Figure 1. -- Counties, rivers, and principal cities and towns of Piedmont Virginia.

The Piedmont landscape is characteristically rolling - in contrast with the plain on the east and the rugged mountains on the west. The general land surface rises from about 300 feet above sea level along the eastern border to between 500 and 1,000 feet at the base of the Blue Ridge; and then, in the last 5 or 10 miles between the base and summit of the Ridge, mounts steeply to exceed, in some places, 4,000 feet in elevation (16).[1/]

The soils, originally fertile, have lost much of their richness through erosion and heavy cropping. Over extensive sections the soils are clearly submarginal for farming. Their chief hope for the future lies in forest production.

1/ Underlined numbers in parentheses refer to "Literature Cited", p. 82.

Original Forest

Piedmont Virginia was originally a wilderness of nearly unbroken hardwood-pine forest. In the south, along the eastern border, stands of loblolly pine extended inland from the great pine areas of the Coastal Plain. But with this exception the Piedmont was predominantly -- and over large stretches almost exclusively -- a hardwood country (2, 5, 6).

Four broad types of forest growth predominated: (1) Along the stream margins and bottoms white and northern red oaks, hickory and yellow-poplar made up the bulk of the timber. Other trees were sycamore, sweetgum, red maple, river birch, and walnut. (2) The lower slopes and moist areas adjacent to streams ran heavily to the white oak-hickory type of forest, with scarlet, black, and red oaks and yellowpoplar the chief associates. (3) On the upper slopes and ridge tops, along with the ever-present hickory, were southern red, black, scarlet, and chestnut oaks; and on the drier ridge tops, blackjack and post oaks. (4) Extending down the mountain slopes and foothills on the west, chestnut and hemlock were found in mixture with the other trees.

This hardwood forest, especially along the slopes and ridges, was patched and dotted with pine -- in the south and east, chiefly shortleaf pine; in the north and west, chiefly Virginia pine. Where fire or other catastrophe had at some time cleared the forest, the pine was to be found in extensive and nearly pure stands. White pine grew in the foothills and mountains at the western border of the Piedmont.

Most of the forest was old growth, with the principal trees large and mature and the quantity of timber amounting to perhaps 12,000 to 14,000 board feet on the typical acre. But all conditions of timber were represented in the district. Fires set by the Indians burned over sizeable areas every year and occasionally damaged or destroyed the old timber, making way for a new succession of brush, saplings, poles, and eventually saw timber.

The total quantity of timber in the original forest was possibly close to 120 billion board feet, of which about one-fourth was pine. In 1940, after 2 centuries of settlement in the district, woods still occupied 60 percent of the total land area, but contained only one-fifteenth as much saw timber as the original forest. The proportion of pine, however, had increased to more than 40 percent.

Tobacco and Land Use

While the first permanent white settlement in Virginia, at Jamestown, was founded in 1607 and during the next few decades the frontier was pushed well back along the principal rivers, it was a hundred years thereafter before the first thin scattering of pioneers established homes in the Piedmont; and it was not until the mid-eighteenth century that the Piedmont began to be opened up extensively (1, 3). The barrier to westward migration presented by the Coastal Plain-Piedmont border was largely a matter of transportation: the border was the fall line, and the falls set a limit to river transport, in those days the only economical means of transport. This

barrier was not fully removed until the era of railroad expansion, beginning in 1836 (8).

Behind transportation, again, lay the overwhelming fact of tobacco as the hub of the economic life.

The story of land use -- forest and agricultural -- in early Virginia is essentially the story of tobacco. Tobacco was first planted at Jamestown in 1612 and within a short space of years had gained a dominance over the life of the people which it was slow to relinquish (4). Tobacco production enjoyed a marked advantage over other types of economic activity. One cause of this was the fact that the English and Europeans who emigrated to Virginia brought with them high standards of living acquired in a mature and integrated economic society and were not prepared to descend willingly to a standard of self-sufficient frontier life. Thus they turned eagerly to tobacco production for export, retaining their position in the industrial pattern of the Old World. Again, tobacco-growing demanded much land, but was saving of capital and labor; and these things were scarce, while land was abundant.

But tobacco culture was also wasteful of the soil. The tobacco plants themselves absorbed large quantities of soil nutrients. And even more important in soil wastage was the erosion which followed the hoeing and shallow plowing of that primitive agriculture.

Under this system farm-land fertility was quickly depleted -- and under it arose the land-use cycle of clearing and abandonment which in later years came to typify the agriculture of Piedmont Virginia.

It is true that the first white settlers to clear the Pietmont forest, in the early years of the eighteenth century, necessarily entered upon a self-sufficing, frontier type of agricultural life. But as roads were pushed westward from the Coastal Plain during the second quarter of the century, settlers grasped eagerly this opportunity to gain access to the sea and to tobacco commerce.

Agricultural Development -- Effect on the Forest

In the decades that followed the entrance of commercial agriculture into Piedmont Virginia, transportation systems, population (fig. 2), and tobacco moved westward in successive waves. So essential a part of the agricultural economy and society did the system of land clearing, exploitation, and abandonment become that it persisted long after the Revolution, when wheat and other grains began to shoulder their way into the field of staple crops. So long as there were virgin lands to be had at home and so long as new lands and new agricultural methods were being developed in the west, staple prices were unlikely to rise -- and seldom did rise -- to the point where it paid to use fertilizers and otherwise intensify the farming system. Even in the late 1830's it was only at the northern end of the Piedmont, where markets and transportation were most favorable, that fertilizing and crop rotation had been introduced on a significant scale (4).

Thus a shifting and unstable agriculture continued to characterize Piedmont Virginia. This is the theme of the story of the district's forests and the key to conditions and problems of the present day.

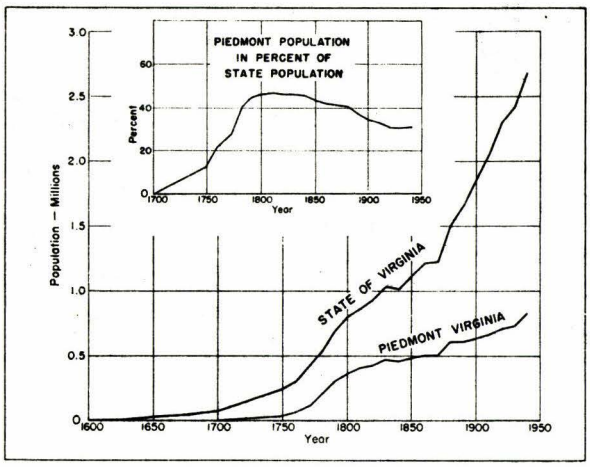

Figure 2. -- Population trends in Piedmont Virginia and the entire State, 1607-1940 (4, 10, 14).

The depleted mineral soils left exposed upon abandoned farm lands furnished favorable seedbeds for pine, but discouraged hardwood reproduction. Seeded in from adjacent scattered trees and clumps (the "forest pines" of the original timber stands), a cover of "old-field" pine developed on these lands. And as the clearing-abandonment cycle continued, the general character of the forest was gradually converted from predominant hardwood to predominant pine. Woods fires, reclearing of once abandoned fields, and generally, the whole migratory character of farming served to further this conversion from hardwood to pine.

During the first half of the nineteenth century the aggregate extent of cleared and improved farm land, which had increased steadily theretofore, reached a nearly stationary level. The migration of agricultural fields in the land-use cycle continued. But it was no longer an expanding agriculture: old land was abandoned as rapidly as new was cleared. After 1850 abandonment began to overtake clearing (fig. 3).

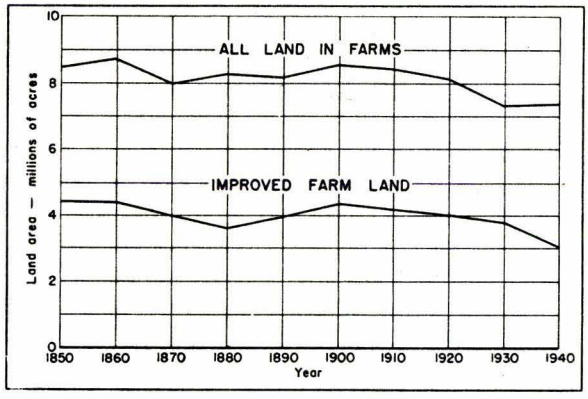

Figure 3. -- Trends in acreage of farms and improved farm land, 1850-1940 (12).

Dwindling of improved farm land, especially after 1900, was a typical phenomenon, save only in the tier of counties along the western border. On the other hand, the area of forest, which had been shrinking continuously before 1850, probably about that time reached a low ebb and has since, with the exception of a short period of farm expansion before 1919, been increasing.

In 1940, farms in the district numbered 73 thousand and occupied 7.4 million acres -- nearly three-fourths of the total land area. Only 3.0 million acres of this land, however, were improved. Today commercial farming is concentrated in two parts of the district (fig. 4). In the south, flue-cured tobacco is still the major crop. In the northwest

dairying and fruit growing are common. Over most of the remainder of the district a general or a self-sufficient type of farming prevails. But depleted soils, with their long history of exploitation, afford only poor returns to agriculture. Nearly 45 percent of all farm families received less than $400 of total gross income from products sold, traded or used in 1939 (12).

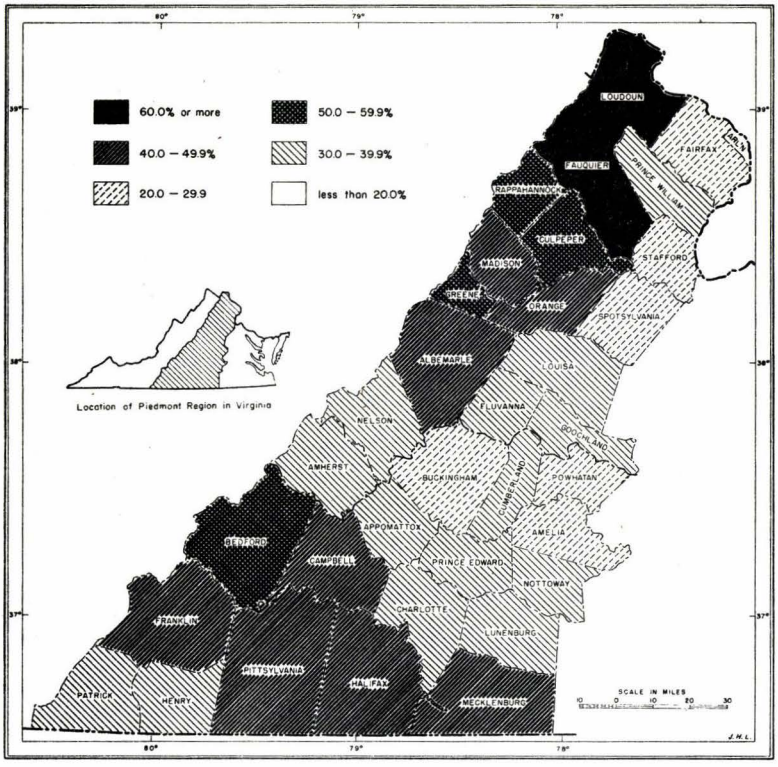

Figure 4. -- Proportion of cleared farm land in the total land area of each county, 1940 (12). (Light cross-hatching, except near District of Columbia, indicates forest concentration.)

With the gradual stabilization of agriculture and suppression of the clearing-abandonment cycle since about 1900, a new change has begun to take place in the woodlands of Piedmont Virginia. The hardwoods of the original forest, especially the predominant oaks and hickories, have invaded the pine stands -- in some places becoming, and in others promising soon to become, the major species. This hardwood invasion has been made possible by the greater permanence of fields and woods. The woods, under better fire protection, have accumulated the layer of forest top soil in which hardwood seedlings can establish themselves and thereafter overtop and dominate the pine. Maintenance of a more or less permanent forest cover, as contrasted with clearing and abandonment, gives the young hardwood an advantage over the pine, which is less able to tolerate shade. Meanwhile continued selection and cutting of the more marketable pine from the mixed stands has steadily increased the proportion of hardwood in the overstory (2).

Development of Forest and Other Industry

In most southeastern coastal states the Piedmont section is the most highly industrialized. But in Virginia the Piedmont is primarily agricultural. With 39 percent of all land in the State, the Piedmont contains 42 percent of the number of farms and 45 percent of the land in farms. Its industrial development is slight as compared with the Coastal Plain. Many Virginia-Piedmont industries are predominantly rural and local in character, their plants, especially in the field of timber processing, being operated

on a part-time basis by farmers and other rural workers. Urban population is still greatly in the minority. Only 28 percent of the district's 830,000 population is urban, as compared with nearly 50 percent (of a much larger population) for eastern Virginia. Nearly eight-tenths of all employed persons are engaged in agriculture; while in the rest of the State only about six-tenths are so employed (15).

Indeed it was agricultural, rather than industrial, development which attended the first exploitation of the forest resource. Of the tremendous quantity of timber cut in the course of land clearing during the long period from settlement until the mid-nineteenth century, it appears that the greater portion was destroyed; and of that used, all but a small part was used locally and underwent a minimum of processing. There was little timber industry or trade in forest products, for transportation was too poor and costly, considering that ample timber was still to be had near tidewater.

After the middle of the nineteenth century, when railroads and other improved means of transport began to make themselves felt in the district, and as the timber in many communities became seriously depleted, a commercial forest industry began slowly to develop, based largely upon the supplies of pine. It was an unspectacular industry. There was very little large-scale timber cutting or sawmilling. Already patchy and scattered as a result of farm-land clearing and abandonment, the Piedmont woods supported much the same kind of industry that exists today -- a diffuse pattern of small, transient mills fed by little woods operations selecting and gathering their timber here and there -- producing, in total, a surprisingly large quantity of timber products, but leaving the face of the land on the whole unchanged.

In 1822, as reported by the Census of Manufactures, the typical Piedmont-Virginia sawmill employed only one or two persons. Even in 1860 the average mill reported only three employees. By 1880 the scale of sawmilling had increased to an average employment of four or five persons, the scale obtaining today. Meanwhile, in the State of Virginia as a whole, the scale of sawmilling continued to rise. By 1890 it had exceeded 9 employees per mill, and in 1909 was nearly 13 (13).

In the same year, 1909, the State of Virginia reached its peak in lumber production, gaining sixth place among the States in output (11). But this peak and this rank among the States were achieved in Tidewater and in the Mountains: lumbering in the Piedmont was continuing in much the same course as it had followed before and has followed since.

Generally speaking, with perhaps the exception of textile manufacture, the other industries of the district have experienced a slow and unspectacular development similar to that of the lumber industry. In 1939 there were only 235 manufacturing and mining establishments with 25 or more employees -- less than one-fourth of all such establishments in the State. The numbers in each type of industry were as follows:

Farm-product and textile industries	99
Forest-product industries	50
Chemical, printing, and other light industry .	39
Metal, machinery, and other heavy industry ...	34
Mines and quarries	13
All industries	235

Chief centers of industrial concentration are Lynchburg, with its wide assortment of factories, particularly textile and clothing mills; the outskirts of Washington, running rather heavily to machinery and transportation equipment; Danville, tobacco and textile center; Martinsville, other towns in northern Henry County, and Rocky Mount, where the furniture industry is massed; Charlottesville and Fredericksburg, textile towns; and South Boston, Farmville, and Bedford, with tobacco and textile manufacture (18).

The development of these industrial centers has had a marked effect upon the distribution of population in Piedmont Virginia, for increasing population has characterized the industrial and better farming districts of the south and west, while stable or declining population has marked most of the remainder of the district. In figure 5, where counties are classified according to population growth, the six areas of most consistent increase mark the location of the six industrial centers with a population of 10,000 or more. All the counties without cross-hatching in figure 4 have shown a constant or declining population in two or more of the past four decades.

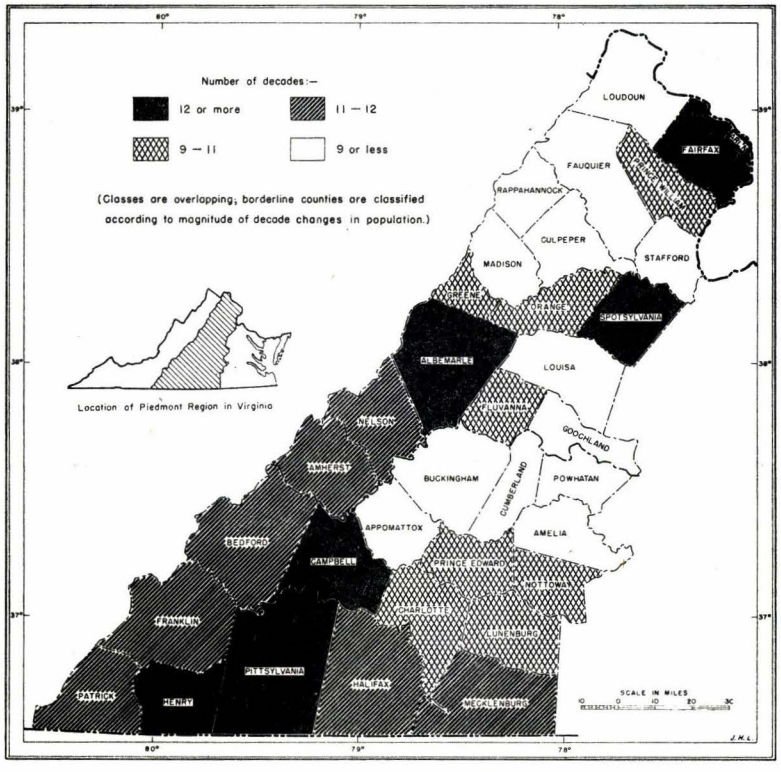

Figure 5. — Number of decades since 1790 in which county population has increased (14).

Section 2. -- THE FOREST -- DESCRIPTION, INVENTORY, GROWTH

Land Use and Forest Ownership

Forests cover nearly 6 million of the 10 million acres of land in Piedmont Virginia. Most of the land not forested -- 3-2/3 million acres of it -- is in farms (fig. 6). Table 11 [2] shows in some detail the use of land -- both in the Piedmont district as a whole and in the two sections lying north and south of the James River.

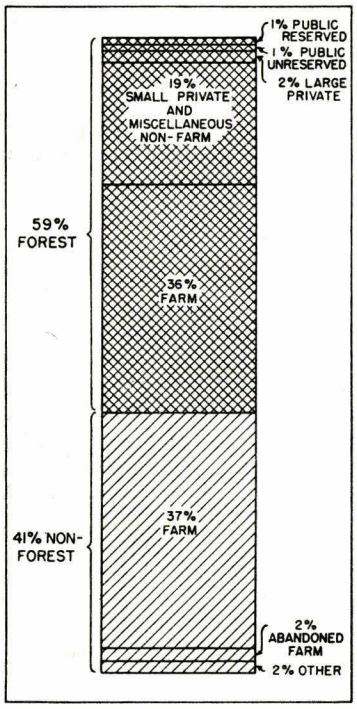

Figure 6. -- Land use and forest-land ownership, 1940.

Farm woodland comprises the major share (61 percent) of the forest; and other small private ownerships, most of the rest (32 percent). Larger industrial forests account for 3 percent of the total area; public forests, 4 percent.

Farm woods have an aggregate area of 3.6 million acres, or 49 percent of all farm land. These woods typically occupy the ridge tops and upper slopes, flanking the pastures and the fields of corn, winter wheat, and tobacco lying adjacent to the narrow valleys. The proportion of farm area in woods is highest in the eastern Piedmont, particularly in the counties south of the James River (table 1 and fig. 7).

The farm woodlands are distributed among nearly 59 thousand farms: four-fifths of the farmers in the district own a portion of the farm-forest resource, the average farmer's share amounting to 55 acres.

Small and miscellaneous private forest holdings other than those in farm ownership aggregate 1,900,000 acres. Individual holdings range in size, for the most part, from a few acres to less than 500. While forest holdings of this type are found throughout Piedmont Virginia, they are notably concentrated along the northeastern belt of poor soils, extending from Fairfax to Campbell County. In this belt, they result from farm abandonment and the reversion of improved lands to forest, a shift which has been taking place at an average rate of 1-1/4 percent annually for the past 30 to 40 years.

Table 1. -- Comparison of woodland areas in Northern and Southern Piedmont, 1940

Descriptive item	Entire Piedmont	Northern Piedmont	Southern Piedmont
Total unreserved forest (M acres)	5,828	2,406	3,422
Farm woodland (M acres).....	3,612	1,266	2,346
Percent of forest on farms.....	62	53	69
Land in farms (M acres).....	7,354	2,986	4,368
Percent of farm-land in woods...	49	42	54

Larger forest holdings, of 500 acres or more, in the hands of timber

2/Tables 11 and following are in the Appendix

industries, total some 185,000 acres. A relatively minor factor in the forest-ownership pattern, they are confined chiefly to the mountain slopes and foothills of the western Piedmont (the region of old-growth hardwoods) and to the narrow strip of loblolly pine country in the southeast.

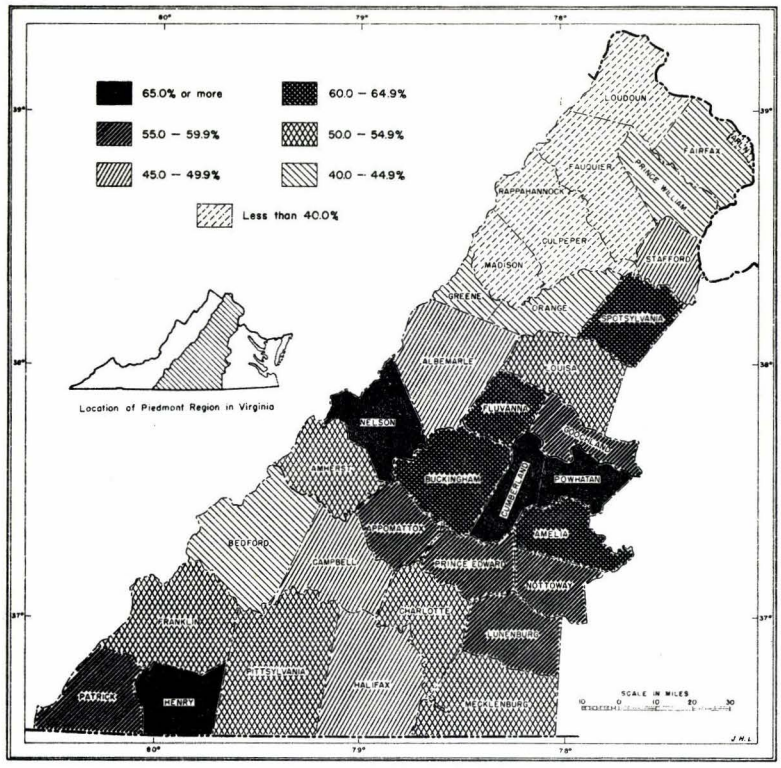

Figure 7. -- Proportion of woodland in the total farm area of each county (12).

About 240,000 acres of forest land is in public ownership -- local, State, and Federal. Small portions of the Jefferson and George Washington National Forests extend from the west into Bedford, Amherst and Nelson Counties, where they include several blocks of mountain-hardwood timber. Five small state forests -- in Buckingham, Appomattox, Cumberland, Prince Edward, and Prince William Counties -- are located mainly upon worn-out farm lands now reverting to forest. The 100,000 acres of forest in the Shenandoah National Park and national monuments and State parks are reserved from cutting and are therefore omitted from consideration in all the following data and discussion regarding forest resources.

Types of Forest -- Location and Extent

The principal types of forest in Piedmont Virginia are the upland hardwoods, accounting for 44 percent of the forest area; Virginia pine-hardwoods, 24 percent; shortleaf pine-hardwoods, 21 percent; and bottomland hardwoods, 6 percent (table 2). The remaining 5 percent of the forest is composed of cove hardwoods, loblolly pine-hardwoods, white pine-hardwoods, and redcedar-hardwoods,3/none of which exceeds 150,000 acres in extent.

Forest stands are, roughly, half of saw-timber size, half of smaller size. Among the smaller stands cordwood greatly predominates. The inference, however, that Piedmont forests are in a fairly balanced condition as a going concern and are favorably developed for production of sawlogs, pulpwood and other merchantable products is substantially modified, it will be seen, by serious deficiencies in timber quality and stand density.

3/See Glossary, p. 54, for explanation of these and other special terms.

The upland-hardwoods type of forest occurs rather generally over the region on drier uplands and low, rolling hills. On the higher lands along the western border the forest is almost exclusively of this type and may be designated, here, as the "mountain-hardwoods" type. Figure 8 indicates the general location of major types of forest. No attempt has been made to show non-forest uses, or to show the patches of intermingled forest types as they actually occur on the ground. For this reason the presence of upland hardwoods east of the foothills is not indicated.

Table 2. -- Forest area, by forest type and condition class, 1940[1/]

Forest type	All conditions		Saw-timber stands	Cord-wood stands	Repro-duction stands
	M acres	Percent	M acres	M acres	M acres
Upland hardwoods.....	2,587.1	44.4	1,189.7	1,272.1	125.3
Virginia pine-hardwoods.	1,391.5	23.9	474.5	731.2	185.8
Shortleaf pine-hardwoods	1,216.6	20.9	680.8	476.0	59.8
Bottom-land hardwoods...	334.1	5.7	192.5	129.6	12.0
Other types.....	298.6	5.1	173.2	99.1	26.3
All types.....	5,827.9	100.0	2,710.7	2,708.0	409.2

1/See also table 12.

In all upland-hardwoods stands, 93 percent of the total quantity of wood, measured in cubic feet, is in hardwood trees, and two-thirds of this is oak (table 13). Typical oaks are the scarlet, black, white, chestnut, northern red, southern red, and post oaks. The moister and more fertile sites encourage yellow-poplar and, toward the east, sweetgum; while the very dry, infertile ridges run heavily to oak and hickory.

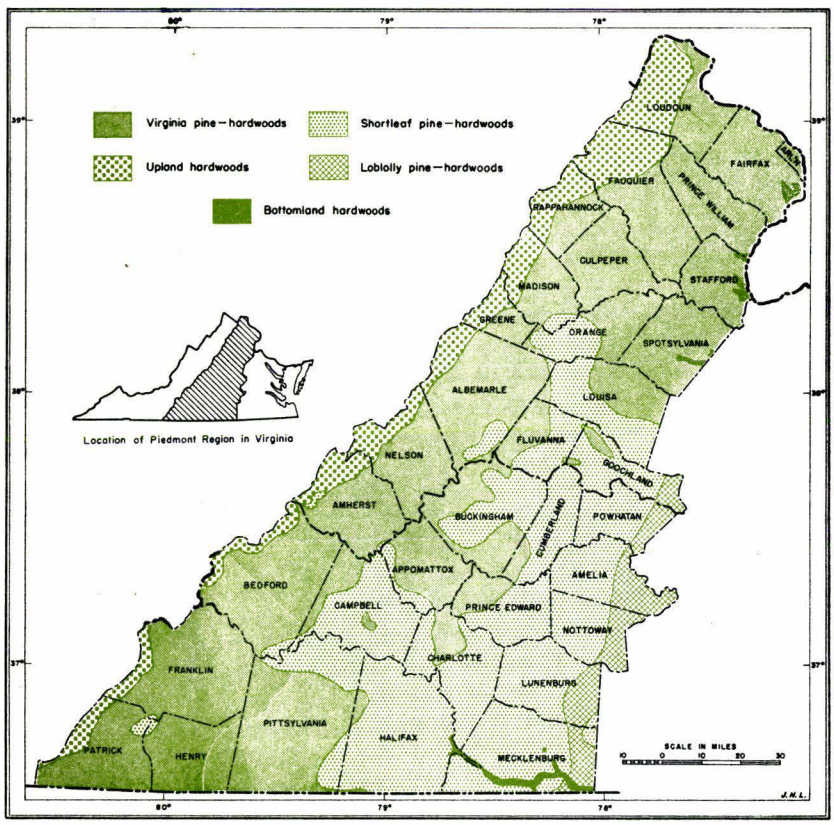

Figure 8. -- Major forest types.

The extent of the different stand conditions -- saw timber, cordwood, and reproduction is illustrated for the upland-hardwoods type in figure 9, and for the other types in figures 10 through 16.

The Virginia pine-hardwoods type occurs rather generally in the Northern Piedmont (north of the James River) and in the western part of the Southern Piedmont, extending into the foothills up to altitudes of 1,000 feet or more. The type includes a considerable acreage of nearly pure pine stands, and on about 50 percent of the total area hardwoods make up less than a fourth of the number of dominant trees. The average stand is 72 percent softwood (in terms of cubic feet); of this softwood, 85 percent is Virginia pine, 14 percent shortleaf pine. Oaks, hickory, yellowpoplar and sweetgum are the chief hardwoods.

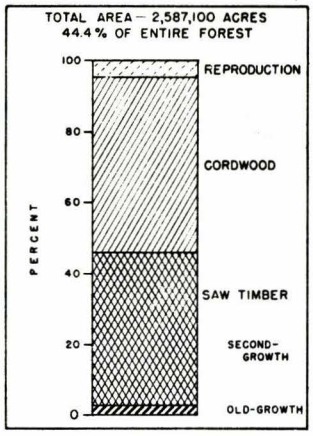

Figure 9. — Extent of forest conditions in the upland-hardwoods type.

The Virginia-pine type is the characteristic forest to invade worn-out old fields and burned-over areas in the northern and western Piedmont. Virginia pine reproduces aggressively. At 10 years of age or earlier, trees begin to bear fair annual crops of seed. Short, crooked, limby, and short-lived, however, this pine is the least desirable of the Piedmont pines. Stands begin to break up at 40 to 60 years, by which time a scattering of hardwoods has usually taken possession of the ground. The result, often is conversion of the forest to the upland-hardwoods type.

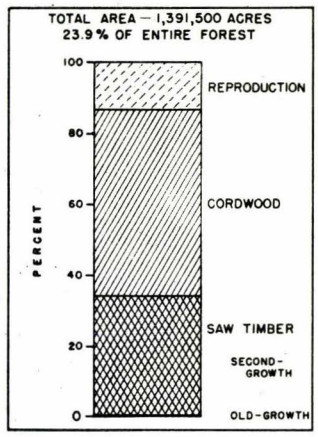

Figure 10. -- Extent of forest conditions in the Virginia pine-hardwoods type.

The shortleaf pine-hardwoods type, on the other hand, is the Piedmont's chief lumber type. Its range is confined largely to the eastern half of the Southern Piedmont, with a limited extension into the southeastern corner of the Northern Piedmont.

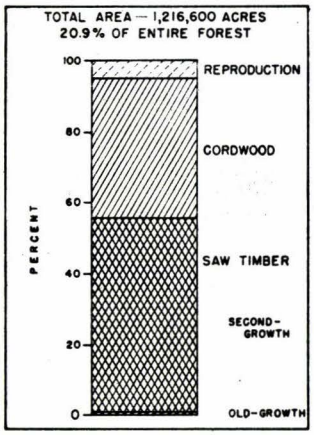

Figure 11. — Extent of forest conditions in the shortleaf pine-hardwoods type.

A better-formed tree than Virginia pine, shortleaf pine is, however, much less aggressive in its reproducing habits. But its more rapid height growth and longer life permit it to win out on the better sites. Within its range it fills much the same position in old-field and hardwood succession as does Virginia pine farther north and west.

The typical shortleaf pine-hardwood forest is about seven-tenths pine and three-tenths hardwood, with shortleaf pine comprising 88 percent of all the pine (measured in cubic feet) and Virginia pine, most of the remainder. Hardwood composition is similar to that associated with Virginia pine.

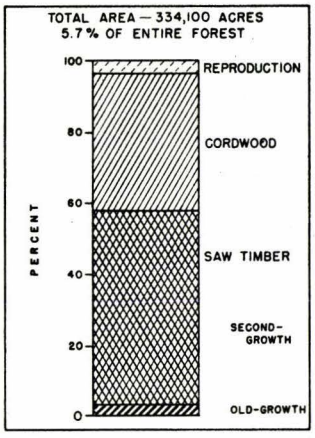

Figure 12. -- Extent of forest conditions in the bottomland-hardwoods type.

The bottomland-hardwoods type occurs along river and stream margins and bottoms, particularly in the broader valleys to the east. Oak is here a minor species, but several of the region's most valuable veneer and lumber hardwoods are common. Yellowpoplar and sweetgum constitute about one-third of the stand and are distinctly more prominent than any other trees. The remainder is composed of a great variety of trees, among which ash, red maple, sycamore, birch, willow, cottonwood, water and willow oaks, elm, holly, and white oak occur most frequently.

The cove-hardwoods type is confined to the western belt of mountains and foothills. There it is found on the deep, moist soils of the lower slopes and stream coves, chiefly those facing in a northerly or easterly direction.

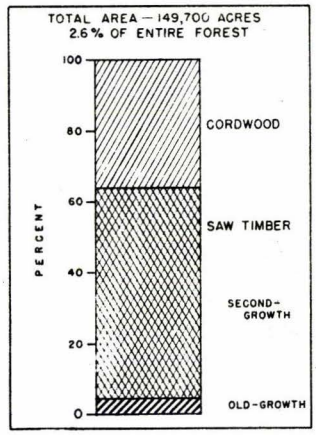

Figure 13. -- Extent of forest conditions in the cove-hardwoods type.

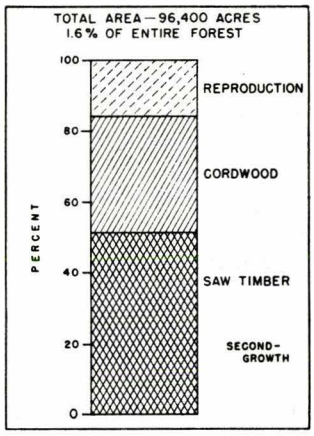

Figure 14. -- Extent of forest conditions in the loblolly pine-hardwoods type.

Yellowpoplar -- favored for veneer, lumber, and small dimension stock -- is the most important tree, constituting more than half of the average stand. Northern red oak, one of the best of the red oaks, with its good form, rapid growth, and clean lower stem, is next in rank. White and chestnut oaks, hickory, dogwood, red maple, ash, and hemlock each comprise 2 percent or more of the stand.

The loblolly pine-hardwoods type occupies a narrow belt along the eastern edge of the district in the south. A highly prized timber tree, fast-growing in both height and diameter, the loblolly pine is nevertheless of minor interest in the Piedmont because of its limited range.

Nearly three-fourths of the stand is pine and nearly two-thirds, loblolly pine. Shortleaf pine is the chief associate. Among the hardwoods

sweetgum, yellowpoplar, white oak, and red oaks are outstanding.

The white pine-hardwoods type is limited almost entirely to Patrick County, in the southwest, where it represents the eastern fringe of more extensive areas of white pine in the mountains. The white pine, itself, makes up 43 percent of the stand, and other pines and hemlock, 16 percent -- leaving a balance of hardwoods, chiefly oaks, of 41 percent.

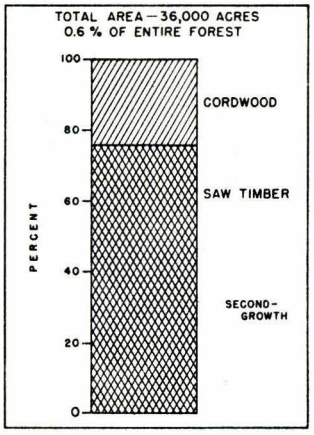

Figure 15. -- Extent of forest conditions in the white pine-hardwoods type.

The redcedar-hardwoods type is largely confined to the Northern Piedmont. The type is found -- usually in small scattered patches -- on dry, limestone ridges and hilltops in the west. Not included here are the red-cedar hedgerows or the scattered trees so commonly left in pastures for shade.

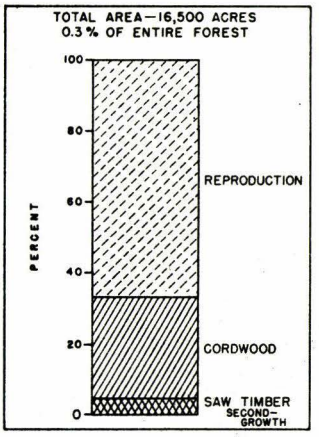

Figure 16. -- Extent of forest conditions in the redcedar-hardwoods type.

Quality and General Condition of Forest Stands

While some timber stands in the district are in good, productive condition, yet by and large the forests present a picture of abuse and decadence -- fire and pest damage, overcutting, and general poor management.

Some of the more hopeful aspects of the situation are these: a total area of second-growth saw-timber stands not recently cut over amounting to 2 million acres, 35 percent of all the forest -- about 100,000 acres of old-growth stands -- a considerable acreage (partly included with the uncut stands) of old-field pine which originated in the land-abandonment crisis after 1920 and now supports well stocked pulpwood and small sawlog timber. Furthermore, a small but apparently increasing proportion of farmers and other woods owners are making a conscious effort to practice forest management for sustained income.

But against these hopeful aspects, and greatly outweighing them, are the factors responsible for widespread forest deterioration.

Forest fire is possibly the most serious of these. Nearly a fourth of the forest shows evidence of fire, and 13 percent of all stands are

markedly damaged. Many fires kill the timber; others burn the base of the trees, opening the way for the entrance of rot. Fire injury is especially great in saw-timber stands of the hardwood types and of shortleaf pine.

Furthermore, when they are weakened by fire or other destructive agencies, trees are laid open to attack by insects, such as the hickory bark beetle, oak pin-hold borers, and southern pine beetle. The pine beetle has been particularly destructive across the central part of the district. Another insect, the locust borer, has virtually stopped the planting of black locust, a valuable tree for erosion control and for fence posts and other products.

Equal responsibility, along with fire, for depleted forests falls upon the practices used in harvesting timber -- heavy cutting, with no provision for regenerating the valuable kinds of trees; and the creaming process, wherein the pines and a few favored hardwoods are cut, leaving a thin stand of culls and undesirables in possession of the ground. Such practices arise largely as a part of the whole farm-woods problem -- the scattered ownership pattern; the indifference of farmers, especially tenants, to the forestry side of their business; lack of contact with satisfactory timber markets; uncontrolled stumpage sales to contractors and others whose only interest in the woods is maximum immediate profit.

The prevalence of heavy cutting is reflected in the present age of timber stands. Short timber rotations, the predominance of fuel wood as a forest product, generations of farm clearing and hit-or-miss restocking of timber have created a predominantly young forest. The average age of saw-timber stands of pine is about 40 years; of upland hardwoods, about 70 years. The entire forest averages only 39 years of age, with less than 5 percent of the stands 100 years or older.

Finally, along with forest depletion has gone the depletion of forest sites through woods burning, soil erosion, and destructive cropping. It has been estimated (19) that 90 percent of all Piedmont-Virginia soils are subject to moderate or serious sheet erosion. Perhaps partly as a result of deteriorated sites, the little-leaf disease of pine has invaded the district, and is now prevalent in the belt of counties from Charlotte to Louisa (9).

A picture of two forest stands typical of Piedmont Virginia appears as figure 17. While there is a fair stocking of very small-size trees, the numbers of trees, even in the saw-timber stand, drop off rapidly above 6 inches. In saw-timber stands of the shortleaf pine-hardwoods type in the section south of the James River the total quantity of wood, in cords, in trees 6 inches and larger in diameter is only about 61 percent of reasonably full stocking, as judged by the densest 10 percent of the stands. A similar comparison for the upland hardwoods of the Northern Piedmont shows only 49 percent stocking. This is essentially what is to be found throughout the Piedmont forest, where the average stocking of timber in cordwood and saw-timber stands runs about 47 percent of that in the heaviest stocked 10 percent for pine types, 51 percent for hardwood types.

The secondary position of pine and other softwoods and the prominent place held by the less desirable species, even in softwood types of forest, is illustrated also in figure 17, even though the considerable number of cull trees in these stands has not been shown. In the shortleaf-pine forest, hardwoods -- chiefly oaks, sweetgum, persimmon, ironwood, and hickory -- dominate the understory, further evidence of the aggressiveness of hardwood reproduction under forest conditions. Hardwoods predominate, also, among the largest trees, the result of heavy cutting of pines in these sizes.

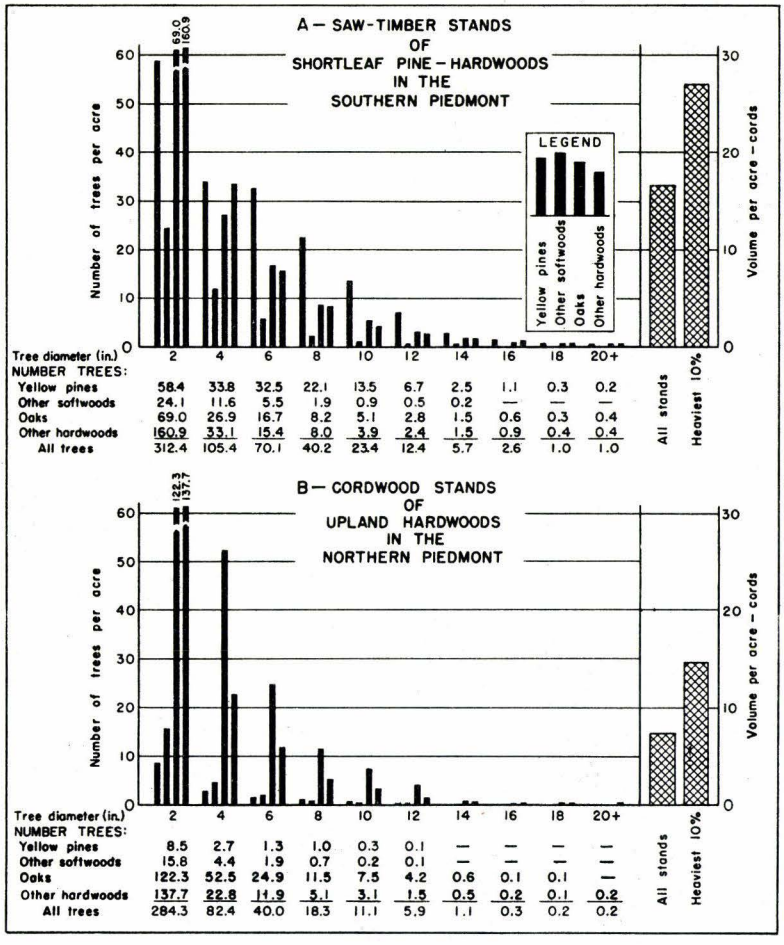
A — SAW-TIMBER STANDS OF SHORTLEAF PINE — HARDWOODS IN THE SOUTHERN PIEDMONT
LEGEND
Yellow pines
Other softwoods
Oaks
Other hardwoods
Number of trees per acre
Volume per acre - cords
Tree diameter (in.) 2 4 6 8 10 12 14 16 18 20+
NUMBER TREES:
Yellow pines 58.4 33.8 32.5 22.1 13.5 6.7 2.5 1.1 0.3 0.2
Other softwoods 24.1 11.6 5.5 1.9 0.9 0.5 0.2 — — —
Oaks 69.0 26.9 16.7 8.2 5.1 2.8 1.5 0.6 0.3 0.4
Other hardwoods 160.9 33.1 15.4 8.0 3.9 2.4 1.5 0.9 0.4 0.4
All trees 312.4 105.4 70.1 40.2 23.4 12.4 5.7 2.6 1.0 1.0
All stands
Heaviest 10%
B — CORDWOOD STANDS OF UPLAND HARDWOODS IN THE NORTHERN PIEDMONT
Number of trees per acre
Volume per acre - cords
Tree diameter (in.) 2 4 6 8 10 12 14 16 18 20+
NUMBER TREES:
Yellow pines 8.5 2.7 1.3 1.0 0.3 0.1 — — — —
Other softwoods 15.8 4.4 1.9 0.7 0.2 0.1 — — — —
Oaks 122.3 52.5 24.9 11.5 7.5 4.2 0.6 0.1 0.1 —
Other hardwoods 137.7 22.8 11.9 5.1 3.1 1.5 0.5 0.2 0.1 0.2
All trees 284.3 82.4 40.0 18.3 11.1 5.9 1.1 0.3 0.2 0.2
All stands
Heaviest 10%

Figure 17. -- Numbers of trees and total quantity of wood per acre in two typical forest stands.

Quality of Forest Sites

Judged by standards of site quality for the southeastern United States, or even by conditions in adjoining districts to the east and south, the quality or productivity of forest lands in Piedmont Virginia is low. For all pine and pine-hardwood stands, the average height of dominant pines at 50 years (site index) is 57 feet, as compared with 61 feet for the Piedmont district of North Carolina and 67 feet for coastal Virginia. As table 3 shows, only one-fifth of the pine forest is on 70-foot or better sites.

Forest site, measured in terms of pine productivity, reveals a

rather well defined geographical pattern within the district, improving toward the south and toward the east (fig. 18). In general, there is little relation between pine-site quality and the productivity of the soils for agriculture.

Table 3. -- Proportion of site classes in the pine and pine-hardwood forest

Site-index class (feet)	Percent of area
40	8
50	36
60	36
70	15
80	4
90	1
All sites	100

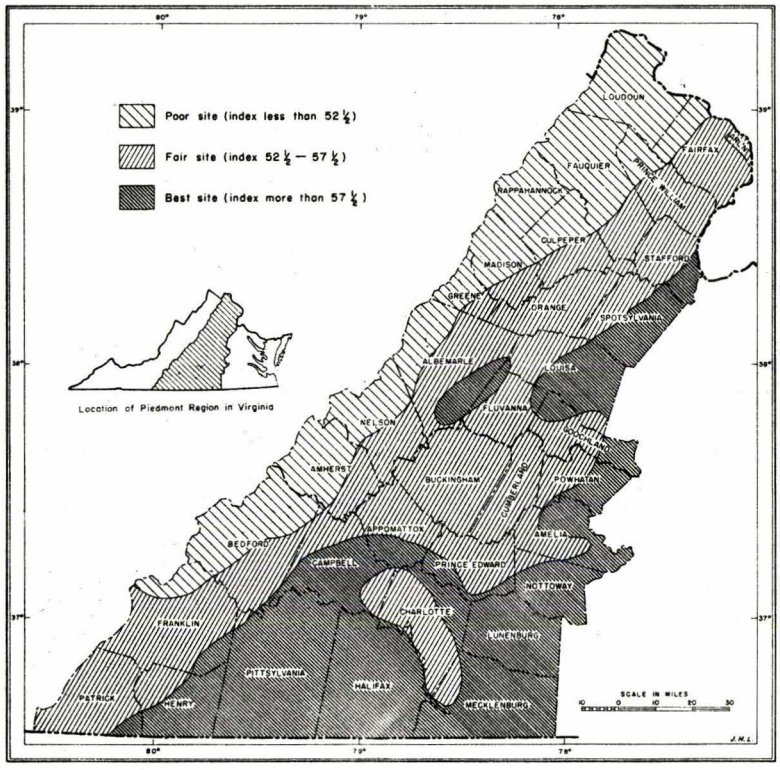

Figure 18. -- Location of three generalized site classes of forest land, based upon height growth of shortleaf and Virginia pines.

Quantity of Saw Timber in Board Feet

The total quantity of timber in sound trees of sawlog size in Piedmont Virginia is 7.6 billion feet, board measure -- an average of 1,310 board feet per acre of forest land (table 17). With 40 percent of the State's forest area, the Piedmont contains only 31 percent of the saw timber, the average stocking per acre being nearly one-fourth less than that for the State as a whole. Again, average stocking per acre in Piedmont Virginia is less than 60 percent of that in Piedmont North Carolina.

About four-tenths of the total board-foot volume is in pine timber. Ninety-five percent of the total is in stands of saw-timber size, the remainder occurring in isolated trees scattered through cordwood and reproduction stands (table 4).

Greater forest area and a 23 percent heavier stocking of saw timber

in the Southern Piedmont put nearly two-thirds of all the saw timber in this section. Volumes of the major lumber species -- loblolly and shortleaf pines and yellowpoplar -- are heavily concentrated in the Southern Piedmont.

Table 4. -- Board-foot volume, by tree species and forest condition, 1940 1/

Tree species	All conditions		Saw-timber stands	Nonsaw-timber stands
	Million bd. ft.	Percent	Million bd. ft.	Million bd. ft.
Softwoods:				
Shortleaf, loblolly pines	1,973.9	26.0	1,861.1	112.8
Virginia pine	1,058.4	13.9	966.7	91.7
Other softwoods	116.6	1.5	108.0	8.6
All softwoods	3,148.9	41.4	2,935.8	213.1
Hardwoods:				
Northern red oak	437.7	5.8	430.7	7.0
Other red oaks	686.5	9.0	649.6	36.9
White oaks	1,261.7	16.6	1,199.8	61.9
Red maple	108.4	1.4	101.0	7.4
Sweetgum	243.3	3.2	233.4	9.9
Yellowpoplar	1,002.2	13.2	963.9	38.3
Hickory	254.6	3.3	239.1	15.5
Other hardwoods	467.1	6.1	444.0	23.1
All hardwoods	4,461.5	58.6	4,261.5	200.0
All species	7,610.4	100.0	7,197.3	413.1

1/See also tables 14 and 15.

The contribution of the different sizes of trees to the total quantity of saw timber in the district appears in figure 19. This figure reveals clearly the predominance of small-size trees. Two-thirds of the quantity of softwood timber is in trees of the two smallest merchantable diameter classes, the 10- and 12-inch classes; and 36 percent is in the 10-inch class alone. In the case of hardwoods the two smallest diameters assigned board-foot volume, the 14- and 16-inch classes account for 44 percent of the timber volume; and the 14-inch class alone, 25 percent. Only 8 percent of all timber is in trees 26 inches and larger in diameter.

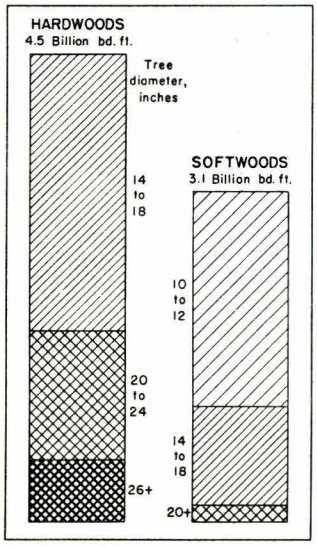

Figure 19. -- Distribution of total quantity of saw timber by tree diameter (see also table 16).

Further commentary on the small diameter and poor stocking of saw-timber stands is suggested by the fact, illustrated in figure 20, that more than half of all such stands contain less than 2,000

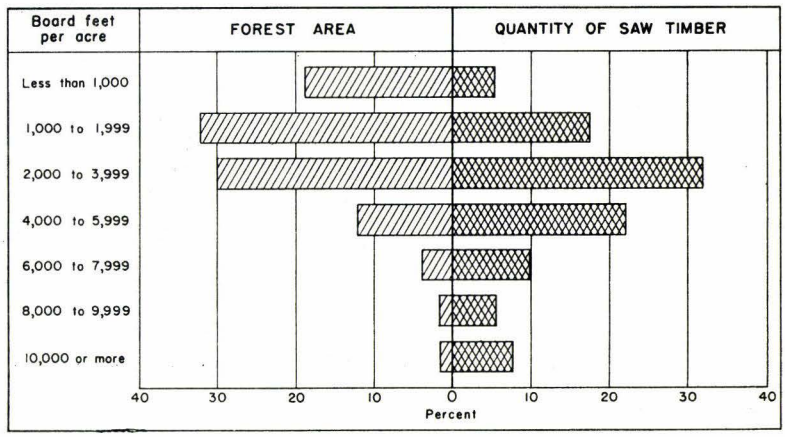

Figure 20. -- Distribution of forest area and quantity of saw timber in saw-timber stands, by timber-density class.

board feet of saw timber per acre; and that only about 7 percent of them contain 6,000 board feet or more. It is true that the distribution of the quantity of saw timber presents a somewhat more favorable picture, with

more than three-fourths of all saw timber occurring in stands of 2,000 board feet or more per acre. However, the averages of figure 20 apply to the fourth-acre patches of forest that comprised the Forest Survey inventory sample, and not to entire blocks of timber. Consequently logging chances on any 50-acre farm woodland or 500-acre commercial property are more likely to approach average -- 1,000 to 2,000 board feet per acre -- than figure 20 suggests.

Quantity of Wood in Cords

The sawlog component of Piedmont-Virginia forests represents less than one-third of the total cubic quantity of wood in trees 5 inches and larger in diameter. The greatest share of this total volume -- approaching one-half of it -- is contributed by trees of less than sawlog size (cordwood trees). Cull trees and upper stems of sawlog trees account for additional amounts (table 5). This small and low-grade material is an important source of such products as pulpwood, fuel, fence posts, and substandard sawlogs.

Table 5. -- Cordwood volume, by tree species and type of material, 1940[1]

Tree species	All material	Saw-timber trees		Cordwood trees	Cull trees
		Sawlog material	Upper stems		
	M cords	M cords	M cords	M cords	M cords
Softwoods:					
Shortleaf, loblolly pines	13,484.6	5,812.5	1,640.3	5,745.8	286.0
Virginia pine	8,895.6	2,702.2	872.3	4,342.3	978.8
Other softwoods	621.4	264.1	53.6	269.6	34.1
All softwoods	23,001.6	8,778.8	2,566.2	10,357.7	1,298.9
Hardwoods:					
Northern red oak	2,732.7	1,055.0	663.0	695.6	319.1
Other red oaks	7,710.9	1,987.2	1,078.3	3,933.4	712.0
White oaks	15,609.4	3,709.7	2,022.8	7,897.5	1,979.4
Red maple	2,191.4	298.5	171.6	899.8	821.5
Sweetgum	2,650.2	590.5	351.9	1,538.7	169.1
Yellowpoplar	8,237.1	2,707.4	1,470.3	3,485.7	573.7
Hickory	3,122.0	823.6	434.4	1,618.1	245.9
Other hardwoods	7,421.7	1,282.8	738.9	3,367.3	2,032.7
All hardwoods	49,675.4	12,454.7	6,931.2	23,436.1	6,853.4
All species	72,677.0	21,233.5	9,497.4	33,793.8	8,152.3

1/See also tables 18 and 19 and fig. 21.

Not included in table 5 are some 2.9 million cords of blight-killed chestnut still standing along the western border of the district, 2.2 million cords of it in trees 13 inches and larger in diameter. Besides its use for fuel, posts, and lumber, the dead chestnut of this area provides raw material for three plants manufacturing tannin extract, and for one pulp mill

The cordwood inventory, which includes both hardwood and softwood trees 5 inches and larger in diameter, reveals more clearly than the board-foot inventory the predominance of hardwood timber in the district. About 49-2/3 million cords, or 68 percent of total cordwood volume, is hardwood. In the Northern Piedmont, hardwood comprises 76 percent of cordwood volume; in the Southern Piedmont, 63 percent. Of this great quantity of hardwood, oaks make up 52 percent; yellowpoplar, 17 percent. These two hardwoods -- together with the two chief softwoods, shortleaf and Virginia pines -- account for more than three-fourths of the total volume in cords.

As regards tree diameter, nearly three-fourths of cordwood growing stock (excluding cull trees and hardwood tops) is in trees of small size, less than 13 inches in diameter. More than a third of it is in 8-inch

and smaller trees (table 20).

The 57-1/2 million cords of wood in sound growing stock represents an average of 9.9 cords per acre of forest land (table 21) -- a poorer average stocking than is found in adjoining districts, both in Virginia and in North Carolina.

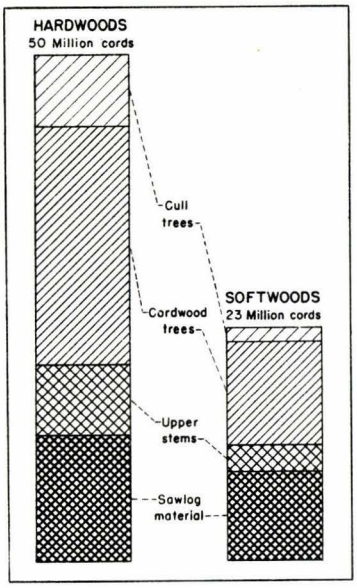

Figure 21. -- Distribution of total quantity of wood in cords, by type of material.

Quantity of Forest Products -- Summary and Appraisal

The inventory of timber resources in Piedmont Virginia has brought out a number of striking characteristics of the forest: a preponderance of hardwood, suitable chiefly for the lower-value uses -- a deficiency of large-size timber usable for veneer and sawed products -- a high proportion of those classes, grades, and species of timber avoided in all but fuelwood cuttings. In the last analysis, any appraisal of the capacity of the district's forests to produce income for its people must be based upon an inventory of the actual, usable timber products that are or will become available for harvest -- for only as they may be converted to sawlogs, pulpwood, fuel wood, and other real products do the board feet and cords of forest timber take on meaning as a source of livelihood.

The highlights of such an inventory are presented as table 6, which shows the quantity of material suitable for each of a few key uses, and the relation of this quantity to the total amount of wood available for all uses. No attempt has been made to assign each kind of timber exclusively to one use, and hence there is some duplication in the table which must be kept in mind in interpreting it. For example, the material shown as suitable for veneer logs and crosstie bolts is included also in the inventory of sawlogs. From this it follows that the percentages in the

last column of table 6 add to more than 100.

Nearly three-fourths of the timber in the district is of a type suitable primarily for fuel wood, although some of this same timber is also usable for pulpwood. (Much of it probably has its highest use as growing stock, to be reserved for future production of larger-size timber). On the other hand, the small proportion of timber suitable for veneer logs, cross-tie bolts, specialty products, and poles is striking.

Table 6. -- Volume inventory of timber resources, according to type of material or typical use, 1940

Type of material	Typical use	Total volume	
		In units of measure	In percent of total forest inventory
Yellowpoplar, white oak, etc. logs 16" and larger	Veneer logs	630,600 M bd. ft.	2
Loblolly, shortleaf, white pine, hemlock saw timber	Favored softwood sawlogs	2,071,200 M bd. ft.	10
Virginia pine saw timber	Other softwood sawlogs	1,058,400 M bd. ft.	5
Hardwood saw timber	Hardwood sawlogs	4,461,500	17
Oak logs 12" and larger	Cross-tie bolts	40,962 M pieces	7
All cedar and specialty woods	Specialty products, fence posts	834 M cords	1
Straight, clear loblolly, shortleaf, Virginia pine	Poles	18,923 M pieces	3
Yellow pine small trees, large tops, usable culls	Softwood pulpwood	14,283 M cords	19
Hardwood ditto and standing dead chestnut	Hardwood pulpwood	9,260 M cords	12
All small trees, tops, culls of fuel-wood species	Fuel wood	53,773 M cords	72

Growth of Forest Stands

The current annual net growth of timber in Piedmont Virginia -- that is, the amount by which growing stock was expected to increase during 1940, with allowance for tree mortality but before deduction for cutting - is 625 million board feet of saw timber, or 3.4 million cords of all material (tables 22, 23, and 24). This total net growth represents an average of 109 board feet or six-tenths of a cord per acre of forest -- 8.2 and 5.9 percent, respectively, of growing stock. The net growth is proportioned among the various kinds of trees as follows, in percent:

	Percent of saw-timber growth	Percent of growth of all material
Shortleaf, loblolly pines	25	22
Virginia pine	21	22
Other softwoods	1	1
Oaks	25	25
Gums and yellowpoplar ...	20	18
Other hardwoods	8	12
All species	100	100

And the percentage of net growth in each condition of forest stands is --

	Percent of saw-timber growth	Percent of growth of all material
Saw-timber stands	72	54
Cordwood and reproduction stands	28	46
All stands	100	100

The proportion of net growth contributed by softwoods is markedly greater than the proportion of softwoods in the growing stock itself: the board-foot growth of these trees amounts to 9.3 percent of growing stock, as compared to 7.6 percent for hardwoods. The corresponding percentages for growth in total volume are 7.4 for softwoods, 5.2 for hardwoods.

Table 7. -- Current annual net growth per acre, by forest type and condition, 1940[1/]

Forest type	Saw-timber stands		Cordwood and reproduction stands	
	Bd. ft.	Cord	Bd. ft.	Cord
Loblolly pine-hardwoods.	262	0.98	31	0.38
Shortleaf pine-hardwoods	176	0.79	55	0.60
Virginia pine-hardwoods.	182	0.79	60	0.56
Bottom-land hardwoods...	183	0.79	59	0.52
Cove hardwoods.....	240	0.88	108	0.80
Upland hardwoods.....	145	0.58	55	0.44
All types.....	168	0.70	57	0.51

1/See also table 25.

However, rates of growth for both hardwoods and softwoods are relatively high. The 145 board feet per acre per year growth in saw-timber stands of the upland-hardwoods type (table 7) exceeds by more than 10 percent the corresponding rate for Piedmont North Carolina, where this forest type is also of major importance. And there are a number of other isolated cases in which the growth rate of Piedmont-Virginia woods exceeds that in the districts to the south and east. While the over-all average growth falls short of the growth in these neighboring districts, it is nevertheless true that, considering the depleted condition of forest sites and growing stock, productivity in terms of growth is at a high level.

Two factors, chiefly, contribute to the rapid growth of Piedmont-Virginia forests. The typical stands of small-size and rather poorly stocked timber are in optimum position to increase existing volume rapidly with a minimum tree-mortality loss. Following from this, and even more important to rapid growth in most stands, is the great number of trees just below merchantable size, having, initially, no volume; the recruitment of such trees into the ranks of merchantability during each growing season increases the growth of the stand by the entire amount of their final volume. Of the 168-board-foot growth per acre in saw-timber stands, 86 board feet, or a little more than half, is due to recruitment of small trees, and more than 90 percent of board-foot growth in nonsawtimber stands is recruited volume. While recruitment is less a dominant factor in growth of all material, it still accounts for more than one-third of the net growth of all stands in cords.

This, then, is one vital reservation in interpreting optimistically the high growth rates in the district: a major share of the new wood added each year to forest inventory is added on the very smallest trees classed as merchantable. Another reservation, suggested in table 7, is that the

fastest-growing types of forest, the loblolly pine-and cove hardwoods, are of the least extent in the district, throwing the least weight into the determination of sum-total net growth. Finally, the very fact that Piedmont forests are now producing new wood at a high, and indeed at near their maximum, rate limits strongly the possibilities for future improvement. If growing stock were to be increased four- or five-fold -- an easily conceivable goal of forest management -- it is doubtful that the accompanying increase in the quantity of growth would be more than 25 to 50 percent. While there is opportunity for improving the composition of growth with respect to sizes and kinds of trees, the total amount of net growth promises to be limited for an indefinite period: soil and climate, the fundamental determinants of growth, can produce just so much, and no more.

Section 3. -- TIMBER CONSUMPTION AND FOREST INDUSTRY

Commodity Drain

From the forest resource and the yearly quantities of new wood produced, is taken an annual harvest of timber for many purposes. This harvest, in 1940, amounted to nearly 470 million board feet of sawlog material, or 144 million cubic feet of all sound material 4/ (tables 26 and 27).

Of the drain of all sound material, 82 million cubic feet, or nearly six-tenths, is taken in the form of sawlogs for production of lumber, timbers, and ties. Next in importance is fuel wood, 36 million cubic feet, or about one-fourth. One-tenth, about 16 million cubic feet, goes into pulpwood. The percentages of total drain accounted for by the various forest products are as follows:

	Percent
Sawlogs	57
Fuel wood	25
Pulpwood	11
Fence posts	2
Veneer logs	2
Hewn-tie bolts	1
Cooperage bolts	1
All others	1
Total	100

Nearly three-fourths of the total commodity drain from Piedmont forests is taken from the section south of the James River. In that section the annual drain amounts to 30 cubic feet per acre of forest land, 4-1/2 percent of the growing stock; while in the Northern Piedmont the drain is 17 cubic feet per acre, 2-3/4 percent of growing stock. This high rate of drain in the Southern Piedmont reflects in part the greater agricultural development there -- the greater use of fuel wood, particularly in tobacco curing, and the more intensive activity of the farm-sawmill industry. In part, also, it reflects the greater extent of more mature stands in the Southern Piedmont and the greater productivity of the forest, emphasized by the prevalence of shortleaf pine, the Piedmont's principal lumber tree.

Shortleaf pine, indeed, together with a small proportion of loblolly pine, accounts for some 62 million cubic feet of the total drain for all commodities in Piedmont Virginia: more than the sum of the two groups of trees next in importance, Virginia pine and oaks. Following are the percentages of total drain derived from the various groups of trees:

4/ See Glossary, p. 54, for explanation of these and other special terms. It will be noted that "drain" includes only wood cut from growing stock: drain does not include products harvested from cull trees or hardwood tops.

	Percent	
Shortleaf and loblolly pines	43	65 percent softwood
Virginia pine	21	
Other softwoods	1	
Oak	19	35 percent hardwood
Gum and yellowpoplar	11	
Other hardwoods	5	
Total	100	

In the northern Piedmont, Virginia pine, shortleaf pine, and oak account for about equal shares of the total drain; while in the Southern Piedmont shortleaf pine is predominant.

As regards tree size, the apportionment of total cubic-foot drain among the different tree-diameter classes is as follows:

	All trees	Softwood trees	Hardwood trees
	percent	percent	percent
6-, 8-inch trees	18	18	19
10-, 12-inch trees	39	45	28
14-, 16-, 18-inch trees ...	32	31	33
20-inch and larger trees ..	11	6	20
Total	100	100	100

These percentages hold approximately for the individual sections of the Piedmont, save that in the Southern Piedmont the drain, like the inventory, shows slightly greater concentration in the largest-size timber; and in the Northern Piedmont, slightly less.

The total saw-timber drain of nearly 470 million board feet represents an average of 80 board feet per acre of forest land, which is 6 percent of growing stock (in the Northern Piedmont, 50 board feet, 4-1/3 percent; in the Southern Piedmont, 102 board feet, 7-1/4 percent). More than three-fourths of board-foot drain is represented by sawlogs, and about one-half of it by shortleaf pine.

Growth and Drain Compared

For the entire forest of Piedmont Virginia, this drain is more than covered by growth, the growing stock increasing during 1940 by 156 million board feet or 84 million cubic feet. The balance of growth and drain during that year was as follows:

	Million bd. ft.	Million cu. ft.
Beginning inventory	7,499.0	3,733.6
Gross growth...	649.7	242.3
Mortality.....	25.2	13.8
Net growth.....	624.5	228.5
Drain.....	468.5	144.1
Net increase...	156.0	84.4
Ending inventory...	7,655.0	3,818.0

Mortality, it is seen, amounts to only about 5 percent of gross growth, or one-third of 1 percent of beginning inventory (growing stock). Board-foot growing stock showed a net increase of 2.1 percent during the year; cubic-foot growing stock, 2.3 percent.

These are substantial percentages of increase. But they are scarcely high enough to promise a material improvement in timber density except over a very long period of years. Even to double board-foot growing stock, assuming that a constant percentage increase could be maintained (which is unlikely), would require 35 years.

Nevertheless, a rate of forest regeneration of this order is probably a sufficiently high goal for the district. It may even be too high. The district cannot be expected to undergo for long a very substantial decrease in the industrial flow of timber products, which form such an important part of its life blood. And on the other hand, the opportunities for increasing timber growth are greatly limited. Some reduction in non-essential drain may be effected through intelligent measures for correcting harmful cutting methods and for permitting the woods owner to practice some abstinence in the use of small timber. If such measures succeed in maintaining a rate of increase in growing stock of more than 2 percent, the result probably must be considered satisfactory.

It is misleading, however, to pursue the question of growth-drain balance too far upon an over-all, district-wide basis. Considerations of particular kinds of timber and of particular localities may outweigh the over-all considerations.

Within the over-all picture of growth surplus over drain, for example, are many items -- often key items -- of deficit. There is very little aggregate surplus in the Southern Piedmont -- 0.9 and 1.5 percent in board feet and cubic feet, respectively, as compared with 4.2 and 3.5 percent for the Northern Piedmont. In the entire Piedmont softwoods show a deficit of 29 million board feet, or about 1 percent of growing stock, and the deficit in the Southern Piedmont amounts to nearly 2 percent. For shortleaf pine alone the deficit there is 4 percent. Growth greatly exceeds drain in nonsawtimber stands, but the two are just balanced in saw-timber stands, and there only because a surplus in hardwoods makes up for a deficit in softwoods. As regards tree diameter, again, there is typically a surplus in small sizes, a deficit in large, with some irregularities due to pulpwood cutting in intermediate sizes, different standards of sawlog merchantability for softwoods and hardwoods, and other causes. Table 8 gives percentages

Table 8. -- Net percentage change in total cubic-foot growing stock in saw-timber stands in the Southern Piedmont, by tree species and diameter class, 1940[1/]

Tree species	Diameter class (inches)				
	All classes	6-8	10-12	14-18	20 and larger
	Percent	Percent	Percent	Percent	Percent
Shortleaf, loblolly pines...	-3.9	-1.0	-5.2	-3.8	-17.1
Virginia pine, other sftwds.	-0.9	-0.8	-1.1	0.6	-7.8
Oaks.....	1.0	2.2	-0.5	2.2	0.6
Gums, yellowpoplar.....	1.5	3.3	0.9	0.6	2.3
Other hardwoods.....	3.6	4.7	1.6	4.1	5.8
All species.....	-0.4	0.8	-2.0	0.4	-0.1

1/See also table 28.

of surplus or deficit in one group of stands where the problems in growth-drain balance are typical.

The Forest Survey data do not reveal what in some cases may be a more serious forest-depletion situation than any of those mentioned; a balance between growth and drain achieved in the face of high deficits in some localities, counterbalanced by substantial surpluses in others. The southeastern corner of the Piedmont and portions of several counties in the central section represent such deficit localities, whose problems fail to appear on the district level because of offsetting surpluses in the mountain and northwestern counties. Even in a region like Piedmont Virginia where some forest industries, particularly lumbering, enjoy a high degree of mobility, it is of no very great direct benefit to people in a community of dwindling forest resources, that there exist other communities where forests are being built up through an excess of growth over drain. And even within those favorably situated communities the individual farmer whose woodland is being overcut has a problem whose only real solution in most cases lies within that farm itself.

The statements just made, pointing out the seriousness of local timber shortages, do not imply an argument for economic self-sufficiency for its own sake. It is recognized, however, that in an area like Piedmont Virginia it is in many cases desirable for individual communities, and particularly for individual farms, to have their own supplies of timber. This results from a number of factors, chief among which are the primary suitability of much land for forest use, the advantages to be gained from organizing forest and mill employment as a supplementary occupation, and the low value, relative to weight, of the great majority of forest products handled in the district.

Lumber Industry

Today as in the past, small timber holdings, small-scale logging, small logs, small mills, and part-time operation and employment characterize Piedmont Virginia's lumber industry. Of the district's 1,196 sawmills, producing 383 million board feet of lumber in 1940, half produced less than 150,000 board feet during the year. One-fourth produced less than 40,000 feet. The distribution of sawmill numbers and production is shown graphically in figure 22.

The great bulk of the sawmills, and virtually all the smallest mills, are farm owned and operated. These mills, as pieces of farm equipment, stand in much the same category as the farm tractor or thrashing machine. During the off-season for farming the farmer and his hands set up their simple sawmilling equipment in the woods and turn out their year's requirements for rough lumber, with perhaps a surplus for cash sale in the market. Neighbors without mills of their own bring in logs for "custom sawing" in exchange for a fee or for a share of the lumber. But most farmers and other small sawmill owners engage in the lumber business on a commercial scale, buying stumpage and selling the lumber. Those without the means to finance such an operation may cut lumber on contract for some lumber yard or dealer, the latter buying the stumpage, assuming the marketing risks,

and paying the mill owner a flat fee for his work. In general, only the larger mills buy delivered logs, though many of them also buy stumpage or use timber from their own land. The percentage of total sawmill production accounted for by each of these operating methods is as follows:

	Percent
Stumpage purchased	56
Contract sawing	24
Timber from own land	9
Logs purchased	6
Custom sawing	5
All methods	100

Mills engaged in operating purchased stumpage or in sawing on contract are, as a general rule, moved directly to the site of each logging operation. More than three-fourths of all mills are classed as portable mills. The typical portable mill is relocated three or four times in the course of a year, and the Piedmont sawmill industry thus presents a constantly shifting scene. Mill locations as determined at the time of the sawmill canvass in 1941 are shown in figure 23.

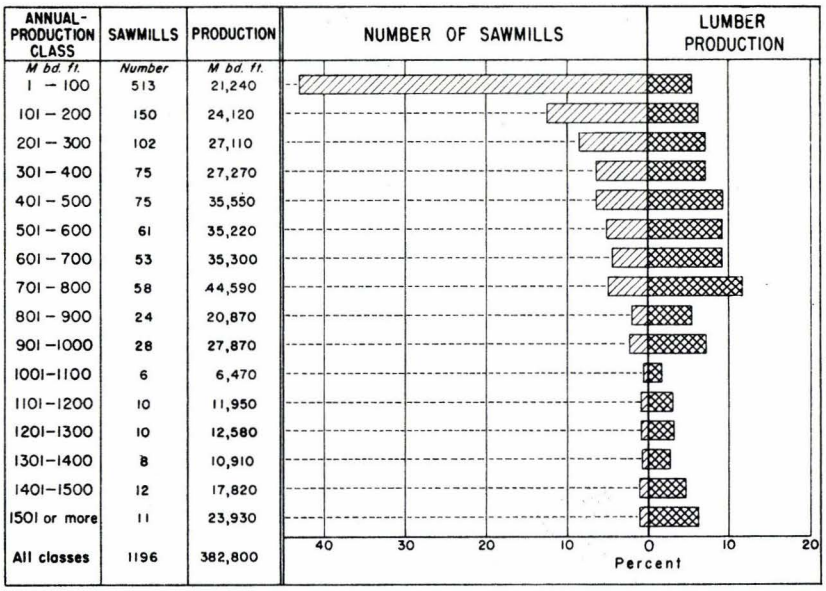

Figure 22. -- Percentage distribution of sawmills and lumber production, by annual-production class of sawmills, 1940.

Under these conditions, log-hauling distances between woods and mill are usually short: less than 1 mile on the average. Logs are skidded by mule or horse, or (in the eastern counties) hauled on high wheels, direct to the mill. For the longer hauls, particularly those in excess of one-half mile, truck or wagon transportation is usual. Logging as it is carried out in the Piedmont, with transient operations gathering their timber from scattered woodlands, is made possible by the district's good network of roads: nearly 97 percent of the land lies within 1 mile of a road.

Piedmont-Virginia sawmills fall logically into four classes, based primarily on daily output capacity and differing markedly in equipment and organization (table 9). There is a marked increase in annual output, days

of operation and number of employees with increasing mill size. Even more marked is the part-time character of operation of most mills. Equipment is simple and often crude. Most mills have only the bare essentials for sawing lumber: carriage, feed works, circular headsaw, and power source. Few mills of less than 6 thousand feet daily capacity have an edger. Edging, in these small mills, is done on the headsaw. Of the mills of less than 10 thousand feet daily capacity, 8 percent have a planer, 1/2 of one percent have a dry kiln.

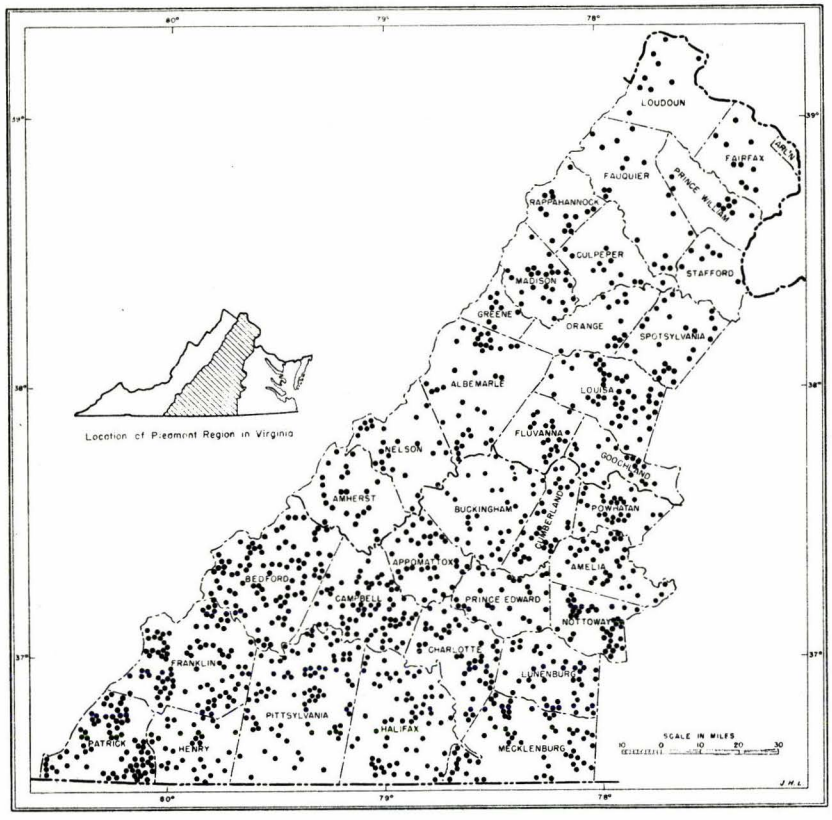

Figure 23. -- Location of sawmills, 1941.

The large number and small size of units in the sawmill industry; their part-time character and position subordinate to other occupations; chiefly farming; and their deficiency in mechanical equipment would be expected to place the industry under the dominance of a few relatively large, efficient and financially stable concerns in the finishing and marketing field. This is, in fact, the case. Dominance over the lumber industry is exercised by the concentration yards, including furniture factories. These yards, of which there are about 40 in Piedmont Virginia, purchase the bulk of the district's scattered output of green, rough, ungraded lumber ---or contract for its production. They dry, plane, and grade the lumber and market it in quantity. They finance the operation of many mills and even, in some cases, provide book-keeping and similar services.

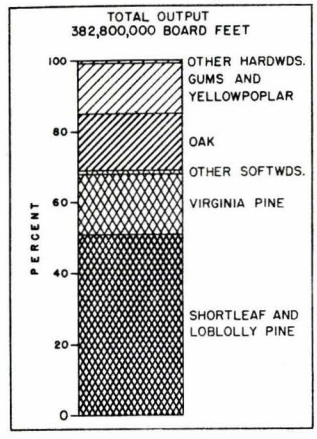

Figure 24. -- Proportion of each kind of timber in the total sawmill output, 1940.

Total production of lumber, timbers, and

sawed ties by the district's sawmills amounted in 1940 to a little more than 380 million board feet, of which nearly 270 million (70 percent) was softwood (fig. 24). In the Southern Piedmont, whose mills turned out more than three-fourths of the total quantity of these products, about 55 percent of the output was shortleaf pine alone. Table 29 contains the production figures for the sawmill and other primary wood-using industries.

Table 9. -- Descriptive summary of sawmills, by daily output-capacity class, 1940

Descriptive item	Daily output-capacity class (M bd.ft.)				
	All classes	1-2	3-5	6-9	10+
Numbers and output:					
Number of mills	1,196	303	687	195	11
Percent of all mills	100	25	58	16	1
Percent of total output	100	3	51	41	5
Annual output per mill, M bd. ft.	320	42	287	798	1,620
Operation and employment:					
Average operating days per year	81	26	86	145	146
Percent custom mills 1/	25	52	20	1	0
Average number of employees	4.3	2.7	4.3	6.2	12.1
Power and equipment:					
Typical horse power (steam equivalent)	.....	18-	20	25	25+
Type of power source:					
Steam (percent)	44	45	45	37	82
Power units (percent)	30	8	33	57	18
Car motors (percent)	15	27	13	1	0
Tractors (percent)	9	15	9	1	0
Water (percent)	1	5	0	0	0
Electricity (percent)	1	0	0	4	0
All types (percent)	100	100	100	100	100
Percent having edgers	13	2	6	47	91
Usual type of feed	.....	Friction	Friction or belt	Belt	Belt or steam

1/Mills one-third or more of whose output is custom lumber.

Concentration in the southeastern Piedmont of shortleaf and loblolly pines, the favored lumber trees, and the better conditions of stocking and site in the southeast make for a concentration of lumbering in that part of the district. Figure 25 suggests that lumber production per acre of forest land is greatest near the southeast corner of the district and declines rather regularly toward the north and west. The small size of mills and the fact that they draw so largely upon nearby supplies of timber make it possible to regard figure 25 as essentially a map of the magnitude of lumber drain upon the forest.

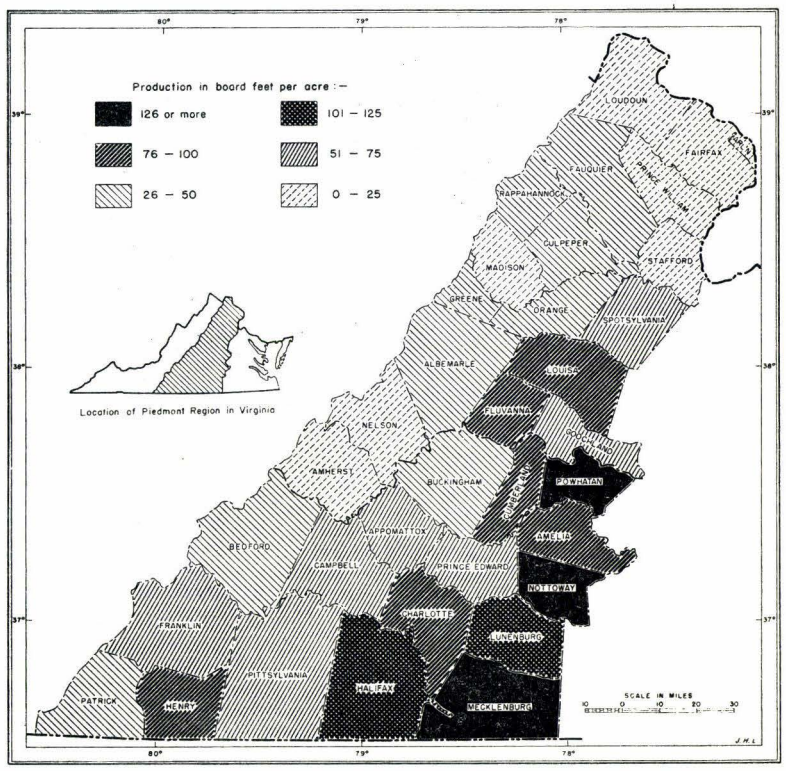

Figure 25. — Lumber production per acre of land other than cleared land in farms, by county, 1940 (12).

The Pulp Industry

The pulp mills of the Piedmont are located near its western border (fig. 26). There are two mills, one producing paper board (and tannic acid) from chestnut, the other producing corrugating paper from pine. But the pulp industry extends, in its woods operations, nearly throughout the Piedmont. Pulpwood, indeed, is a major forest product and source of woods employment. In 1940 the harvest, including chestnut, amounted to about 270,000 cords, the great bulk of which was shipped by railroad over distances as great as 200 miles, to mills located in the Coastal Plain and mountain districts of Virginia (fig. 26) and in other States. Three-fourths of this wood was pine. The Piedmont pulpwood industry is favored by a good system of railroad transportation, with virtually no area in the district situated beyond 15 miles from a railroad.

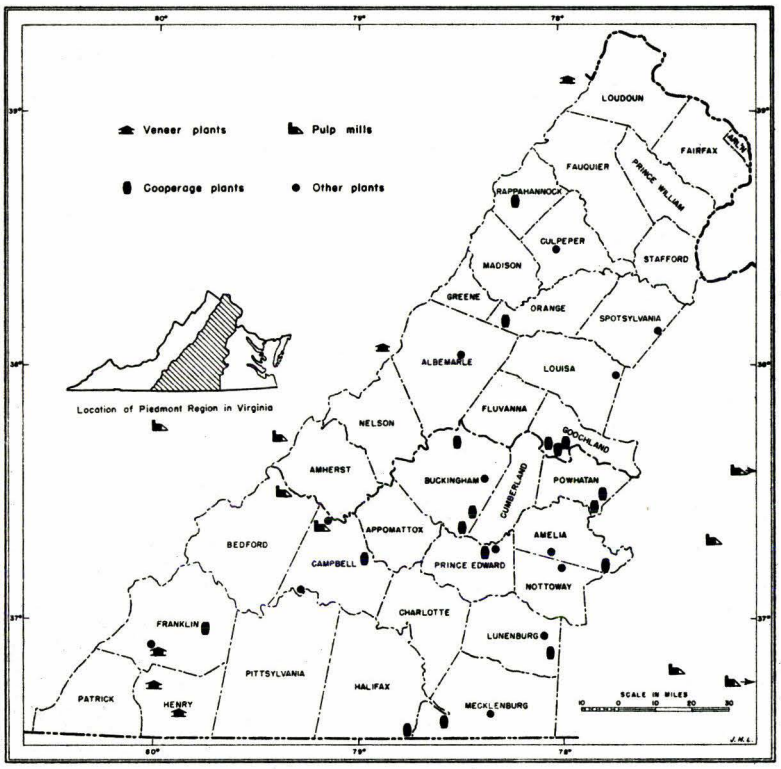

Figure 26. -- Location of primary wood-using plants other than sawmills, 1941. (Some of the outside plants important as markets for Piedmont timber are shown.)

Areas of concentration of pulpwood operations are indicated in figure 27.

Veneer Industry

Like the plants of the Piedmont pulp industry, those of the veneer industry are all located near the district's western border. But unlike the pulp industry, woods operations, also, are confined to the west. The district supports three mills manufacturing rotary veneer and plywood. Two additional mills just across the western boundary draw a substantial share of their supplies from the district (fig. 26).

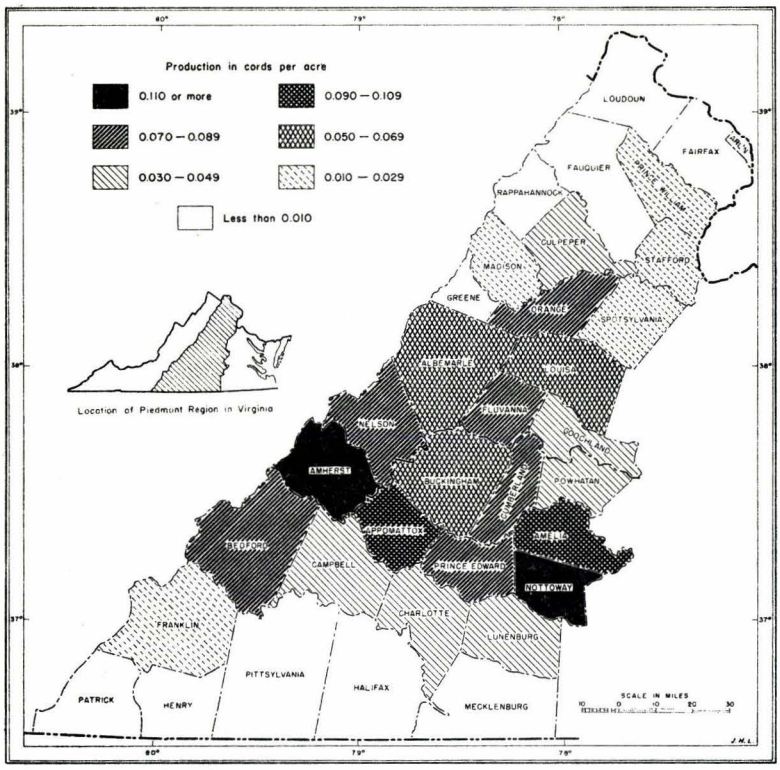

Figure 27. -- Estimated pulpwood production per acre of land other than cleared land in farms, by county, 1940 (12).

Piedmont veneer mills consumed in 1940 some 8-1/2 million board feet of logs. These logs were purchased delivered at the mill. Three-fourths of the timber was yellowpoplar; most of the remainder, sycamore and black tupelo.

Cooperage Industry

There are 17 plants in Piedmont Virginia manufacturing barrel staves or headings. The numbers of cooperage plants which produce each of the principal types of product are as follows:

	Number
Nail kegs	5
Potato barrels	4
Tobacco hogsheads	2
Other slack cooperage	5
Tight cooperage	1
All types	17

Employment in these plants ranges from 4 to 18 men, with an average of 9. Shortleaf pine is the principal wood used; together with loblolly pine, it comprised nearly nine-tenths of the 18,000 cords of total plant consumption in 1940. Virginia pine, yellowpoplar, and white

oak, in about equal amounts, made up the balance. Most of the timber was purchased as stumpage from farmers.

Other Primary Forest Industries

Within the district are 13 other wood-using plants which take logs or bolts direct from the woods as their raw material. Following are the types of plants, the number of each, and the chief woods used:

Excelsior (1): pine.
Handles (5): hickory, oak.
Wood turnings (1): pine.
Insulator pins (2): black locust, oak.
Dimension stock (1): oak, sycamore, walnut.
Cedar chests (1): cedar.
Picker sticks (1): hickory.
Wooden utensils (1): sweetgum.

The 1940 wood consumption of these plants, other than the cedar-chest factory, was 6,200 cords.

Fuel wood and piece products comprise the balance of timber production. Of these, fuel wood assumes chief importance in point of quantity, its annual production amounting to 1-2/3 million cords. In fact, fuel wood comprises more than half of the total quantity of wood, in cubic measure, produced or consumed by primary forest industries in Piedmont Virginia -- the lumber industry included. Forty-three percent of the wood used is oak; 37 percent, pine. It is estimated that more than two-thirds of the fuel wood is taken from dead and cull trees, tops and limbs of sound trees, mill waste, and other sub-standard material -- representing, on the whole, an efficient utilization of this material. Only about 8 percent comes from sawlog portions of sawlog-size trees. This represents, likewise, only about 8 percent of the total harvest of sawlog material.

Secondary Wood-Using Industries

Within Piedmont Virginia are some 125 plants using lumber or other partly finished wood products as a major raw material in manufacture (7). The numbers of these plants by type are as follows:

	Number
Planing and millwork.....	70
Furniture.....	24
Yarding and treating.....	10
Containers.....	6
All others.....	15
All plants.....	125

The planing and millwork establishments are spotted rather generally throughout the district, with some concentration in the large towns, and in the southeastern counties where lumber production is greatest. Many of the plants serve as concentration yards. Their relation to the sawmill industry

has been noted. However, less than half of all the lumber they use is produced within the district.

Two thirds of the furniture factories in Virginia are located in the Piedmont. Here they are largely confined to the southwestern counties, centering upon Martinsville and Bassett, in Henry County, and Rocky Mount, in Franklin County.

Employment and Income

Cutting, preparing, hauling, and processing timber products affords annually almost 5-3/4 million man-days of employment. The total number of individuals engaged in these activities amounts to some 35,000 -- more than one-fifth of the entire personnel in agriculture, industry, and business in Piedmont Virginia. Table 10 shows the numbers of men and man-days of work in the various types of employment. The number of workers producing fuel wood and fence posts for home use has not been shown, since it would include nearly every farmer in the district and would not be comparable with other items in the table. Because some individual workers engage in both woods and mill work and others are employed in several different primary industries, the total number of men in these industries, as shown in the table, is less than the sum of constituent items. This avoids double counting.

Table 10. -- Employment in forest industries, 1940

Industry	Total employment		Woods employment		Mill employment	
	Men	Man-days	Men	Man-days	Men	Man-days
Primary industries:						
Lumber	9,160	1,004,600	5,000	459,600	5,660	545,000
Veneer	250	58,600	80	17,900	170	40,700
Cooperage	240	32,800	80	11,200	160	21,600
Hewn ties	360	36,200	1/ 360	36,200	.....	.....
Pulp	3,600	292,000	1/ 3,600	292,000	(See "others")	
Fuel wood for sale	14,370	503,200	1/ 14,370	503,200	.....	.....
Fence posts for sale	2,040	7,100	1/ 2,040	7,100	.....	.....
Poles and piles	50	8,800	1/ 50	8,800	.....	.....
Others	1,400	374,400	130	12,000	1,270	362,400
Total	29,720	2,317,700	23,960	1,348,000	7,260	969,700
Fuel and posts for home or farm use	.....	2,073,300	.....	2,073,300	.....	.....
Secondary industries	5,360	1,340,300	.....	.....	5,360	1,340,300
All industries	35,080	5,731,300	23,960	3,421,300	12,620	2,310,000

1/Computed from the man-day figures on the basis of estimates of the average period of employment per man.

Table 10 reveals several striking facts. One of these is the overwhelming position of fuel wood in the forest-employment scheme. Of all industrial woods employment in Piedmont Virginia (including primary transportation), nearly three-fourths arises in fuel-wood production. Even if the entire forest-industrial employment is considered -- in mills as well as in the woods, and in secondary as well as primary industries -- fuel wood still accounts for about 45 percent of the total. Another fact is the typically part-time character of forest-industrial employment, particularly woods employment. Woods laborers other than those who make fuel or posts for home use put in only about 55 days, a little more than 2 months, during the year. For most of these people, and for many of those in the plants as well, this work is a side line to farming.

Employment in the woods, and plant employment on timber products produced within the district, together with stumpage returns and other income arising directly from the district's forests, accounted for about 10 percent of all the income received by the people in 1940.

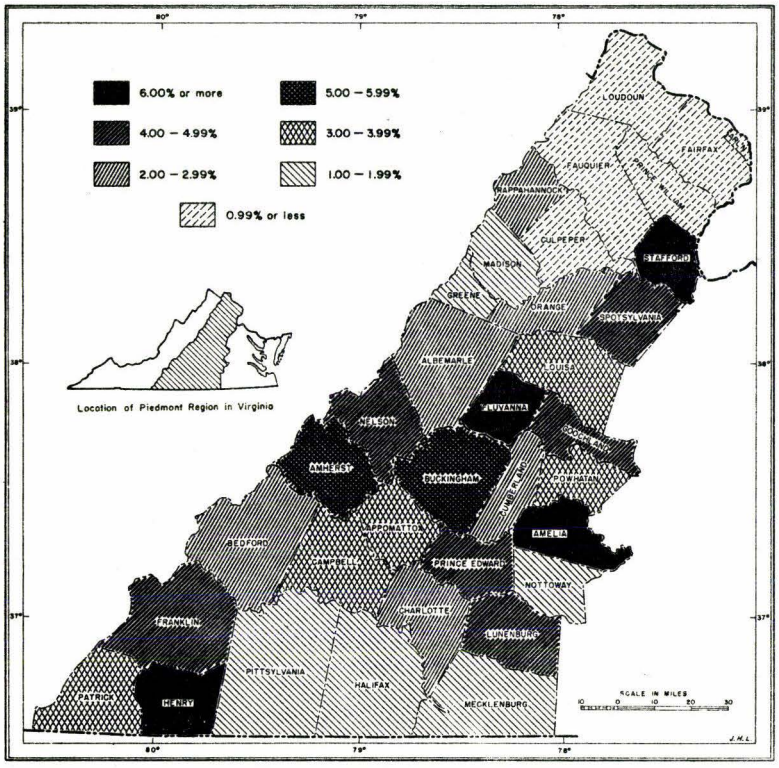

Figure 28. -- Value of farm-forest products sold, in percent of the value of all farm products sold in each county, 1939 (12).

Sale of timber furnished about 2 percent of farmers' gross cash income from the sale of farm products in 1939 (12). This proportion ranges from a negligible figure to nearly 8 percent in individual counties, running especially high in the central and southwestern counties (fig. 28). Not included in these income figures is the value of products used on the farm or the wages received from off-farm employment, of which a substantial part was forest employment.

Section 4. -- PROBLEMS AND PROGRAMS

The depletion of forests and the strong limitations placed upon them in contributing to the income of Piedmont Virginia arise largely from three major forestry problems -- overcutting, inefficient timber marketing and utilization, and fire.

Overcutting Problem

One of the chief forest problems in Piedmont Virginia is the destructive cutting so prevalent throughout the district. This forest exploitation is favored by many circumstances. The complete network of roads gives to nearly every patch of woods a high degree of physical accessibility. Frequent railroad lines furnish direct connections with the pulp mills of the State. These mills, together with the other wood-using plants, and particularly the itinerant sawmills, provide markets for most of the types of timber -- even of the smallest sizes -- growing in the district; and a heavy demand for fuel wood helps to fill the gaps left by processing industries.

Working in conjunction with physical accessibility and marketing opportunities are the ability and the necessity for labor and industry in Piedmont Virginia to draw heavily on forest resources. The poverty of the soil over great sections of the district throws a large population upon the forests as a major source of livelihood. When work is scarce and the prospect of farm income limited, the owner and laborers in a small sawmill can afford to conduct operations in timber which will meet only the very lowest production standards, particularly when stumpage prices are themselves low. Logging and pulpwood cutting as a source of part-time employment thus can be carried on in timber which is extraordinarily sparse, small sized, and poor in quality.

The timber owner, in his turn, can scarcely escape the circumstances which force forest liquidation. Chronically in pressing need of cash income, he takes out, at frequent intervals, whatever trees can be found that will yield a little wood for sale -- pulpwood, a tie, or a substandard sawlog -- products of low grade and value. In this way he keeps the forest trimmed down close to the lowest limit of merchantability. His need for timber income leads to the perpetuation of that type of timber stand from which the income is lowest.

Entering the market as an anxious seller, with mostly low-grade products to offer, the timber owner helps to maintain low stumpage prices. Buyers, on their part, typically make their offers "by the boundary," on a lump-sum basis, setting their estimates low so as to allow for the wide error to which these estimates are often subject. Resulting poor returns from his woods lead the timber owner to place a low value upon his woodland and so to neglect whatever care might be given it to improve its productivity. The poverty of the forest and that of its owners represent in effect two segments of a vicious circle.

Meanwhile, forest depletion is furthered by the destructive cutting methods attendant upon lump-sum contracts, by the average timber owner's

reluctance to engage personally in the logging operations, and by widespread indifference to the potentialities of the forest.

It is not easy for any individual to overcome this situation, long established in custom. The Virginia Forest Service, for example, in attempting sales of selected and marked timber from the State Forests, has found difficulty in obtaining bids, the buyers having access to ample timber nearby which can be bought and cut without restriction. Individual timber operators, again, feel that they cannot afford to follow advanced cutting practices when other operators are not doing so and when the chief lumber market is for run-of-the-mill grades.

Under the pressure of these circumstances, only a small proportion of woodland owners make a conscious effort to manage their woods for a continuous yield of products. Over the district as a whole the proportion is about 5 percent.

During recent years the public has given increasing thought to this question of forest depletion through bad cutting practices. The sentiment is growing that just as there is a measure of public concern in forest rehabilitation, so there must be a measure of public control over forest management. In one county in the central part of the district, for example, where woodlands have been badly abused and their contribution to local living seriously impaired, a citizens' committee was formed in the winter of 1941-42 to study the forest situation. Farmers and professional and business people, including representatives of the lumber industry, formed the committee. The only basic solution to the problem of private mismanagement of forests, they have concluded, is public legislation to control cutting practices. The case of this committee is not an isolated one. Indeed, it is being increasingly recognized, especially in those localities where the pinch of forest exhaustion is beginning to hurt, that only through public regulation can a determined minority be prevented from endangering the interests of the people at large.

In support of a program of public regulation, several supplementary measures appear to be needed. One is public education, aimed at acquainting people with the facts of the forest situation. Another is public assistance in extending credit to small woodland owners, permitting them to let their timber grow so that eventually it can produce regular yields in full measure, commensurate with the district's needs for forest income and employment. Still another is education, service, and assistance -- both public and private -- to timber owners, to acquaint them with approved forest-management methods and to demonstrate the results which may be expected from practicing them.

Marketing Problem

On a par with overcutting as a major forest problem in Piedmont Virginia is the problem of timber marketing and utilization. It is the problem of low returns to the timber owner from the cord of wood and the thousand board feet of logs that he sells, and the low returns to the labor -- and in many cases the business enterprise -- engaged in cutting

and milling those products.

Most farmers and other woodland owners have little or no idea of the quantity and quality of standing timber in their woods. When they make sales on the customary lump-sum basis they are at the mercy of the buyer, who, himself, often can estimate timber volumes only in the roughest sort of way. To provide a margin of safety, estimates are usually placed very low. One mill man in Halifax County, purchasing timber by the thousand board feet log scale, estimated that he would get between 15,000 and 20,000 feet from one tract. When the operation was completed he had cut 75,000 feet. A woods owner in Buckingham County, offered a lump sum of $35 for his timber, decided instead to sell it to another buyer by the thousand board feet. The tract yielded about 125,000 board feet of logs and returned the owner between $600 and $700.

Apparently there is great need for a staff of technical consultants, working under the direction of the State Forester and Extension Forester, helping timber owners to appraise and mark their timber for sale and advising them on marketing. Such work might well be financed by fees charged per thousand board feet or cord of timber marked. The demand for this service would probably justify placing one consultant in each small group of counties. Furthermore, there is now believed to be opportunity for private consulting foresters to engage in this type of work in small groups of counties in the principal timber-producing sections.

Even if sold by the unit of measure, however, timber customarily yields but poor returns. Except in the southern tobacco counties, where owners often do their own logging, owners customarily make sales on the stump, forfeiting the labor income they might otherwise receive. Again, the principal outlet for saw timber is the small, inefficient portable sawmill operating under the domination of the concentration yard -- turning out a low-quality, mostly ungraded product and consequently able to pay only a low price for raw material. The outlet for pulpwood in any locality is in most cases only one or two pulp mills, which are thus largely free to dictate the terms of the market. Pulp companies purchase their wood through contractors, to whom shipping points are assigned. These contractors buy the wood direct from farmers and other timber owners -- or they may get their wood through subcontractors, who in turn purchase it from owners or further intermediaries. Two layers of pulpwood contractors are common; and in at least one locality, in one of the central-Piedmont counties, four distinct layers may be recognized, each taking a cut from the mill price, with consequent reduction in the price paid the timber grower.

It is not the timber owner alone who suffers from the marketing situation. In the field of lumber, the timber buyer, logger, and sawmill man are scarcely better off than the owner, for although they get their raw materials cheaply, the low quality of these materials and the inefficiencies in sawmilling and subsequent marketing provide little room for profit. Generally speaking, it is the whole community which suffers from the problem of timber marketing and utilization, just as the whole community suffers from the mismanagement of the standing timber.

The individual can do little to improve these conditions. But on the other hand the cooperative form of marketing organization, which in some cases has surmounted individuals' handicaps, here seems to offer little promise. The people of Piedmont Virginia have had slight experience in cooperative organization, and none at all in the field of forestry. The few attempts made to organize forest cooperatives have been discouraged at an early stage. The fundamental factor in the present marketing situation -- control of outlets by a very few ultimate buyers --would remain unless a cooperative could itself operate a processing plant of considerable size and diversity. To do this efficiently would require a greater area of fully productive forest than now exists in the district. Thus in most of its phases the marketing and utilization problem is resolved into the problem of forest depletion, and its final solution must await a successful attack upon the latter problem.

Meanwhile there are several steps which can be taken. In one county in the southern tobacco section the Agricultural Agent has until recently been designated by the pulp mill to act as intermediary between some of the farm-woods owners and the mill, arranging for pulpwood shipments and allowing the farmer an equitable price for his product. In this and other ways the pulp companies can help to relieve timber owners of the burden of multiple contracting. In the sawmilling field, education can undoubtedly make some improvement in cutting and grading practices, and technical efficiency can be greatly increased through the introduction of improved types of small mills.

Even under present conditions, however, the forest owner can get a reasonably fair return by careful management of the cutting operation and by seeking the best available outlets for his wood. One farmer in Louisa County, who owns about 100 acres of shortleaf pine with a stand of some 16 cords per acre, is managing his tract on a sustained annual-yield basis, cutting the trees in groups for pulpwood, sawlogs, and poles. His yearly harvest amounts to about 50 cords, or one-half cord per acre, roughly equivalent to net growth. After payment of cutters' wages and transportation costs his net annual receipts have averaged $225, or $2.25 per acre. From most of the cordwood and saw-timber pine stands of the district, a yearly stumpage return of $2.00 or more per acre may probably be realized at present if the owner has his timber carefully marked and cut and finds the best available markets.

Two dollars of net annual return per acre would mean, for the typical farmer owning a 55-acre woodland, about $70 of cash income every year from the sale of wood not needed on the farm. In the light of low farm incomes in the district, this is a substantial sum of money. In 1939, 27 percent of all farm families received a total gross farm income of less than $250, including the value of all products used on the farm, traded, or sold. In the same year, 45 percent of all families received less than $400; 62 percent received less than $600 (12).

Only a small part of the returns of low-income farmers is in the form of cash: most of their income is in the form of subsistence -- products produced and used by the household. Subsistence farms, where such

products formed the major part of income, comprised 57 percent of all farms in 1939 (12). It follows that a possible net return of $70 cash from the woods may be a critical item of income for many woods owners -- the means to discharge pressing cash obligations like taxes, doctor bills, and installments on debt.

It is not the objective of any forestry program to prolong the existence of maladjustment in farm population -- to offer any encouragement to farmers to remain on overcrowded, infertile crop lands in the face of a crying need for out-migration, fewer and larger farms, and land retirement. One of the main objectives of a forestry program, however, is to increase the income from forest land so that as many as possible of the existing population may remain to enjoy a reasonable level of living from the pursuits available to them, farming and forestry included. Part of such an increase in income must be obtained through increased efficiency in timber production, processing, and marketing. But part should come, also, through production of greater quantity and quality of timber products.

This brings to the fore another type of marketing problem: In order for increased timber output to raise income, there must be a demand for this timber; volume and quality production alone do not guarantee high returns. It is the long-run problem of translating production into income.

How successfully the district meets this problem will depend upon its participation in the expected national expansion of such fields as residential housing, pulpwood production, and the use of veneer and plywood. Also it may depend upon increased exports of timber from the district; and, again, upon development of industry to meet new needs of the localities themselves.

Fire Problem

The third general forest problem in Piedmont Virginia is that of fire. Forest fires of the past are responsible for much present woods depletion and cull timber. Although in recent years fires have been greatly reduced in extent, they still cause considerable damage, particularly in isolated years when weather conditions are unfavorable. During the 5-year period 1937-41, in the 32 Piedmont counties which belong to the State protection system, an average of about 18,000 acres, or two-fifths of one percent of the protected forest area, was burned over annually. In a number of counties fires burned between one-half and one percent of the protected forest land (fig. 29). Of the typical year's 840 fires, nearly 40 percent started from brush, pasture, and field burning, mostly in the spring; about 35 percent were started by careless smokers, mostly fall hunters; railroads and incendiaries each accounted for less than 10 percent of the number (17).

The extent of fires in recent years has been remarkably small, considering the meager allotments available to the Virginia Forest Service for fire protection. Combined contributions of Federal, State, and county governments and of the few private land owners who pay into the fire fund have amounted to little more than one cent per acre of land protected.

Perhaps the most pressing need is for funds to allow the three unprotected counties of Piedmont Virginia to be brought into the protection system. An increased appropriation is needed, also, to intensify the now badly overextended system in protected counties -- to permit reducing the size and increasing the number and effectiveness of administrative districts. The Piedmont is now comprised largely of two such districts, with gross acreages of 4 and 6 million acres; whereas an idal administrative district should not greatly exceed 1 million acres.

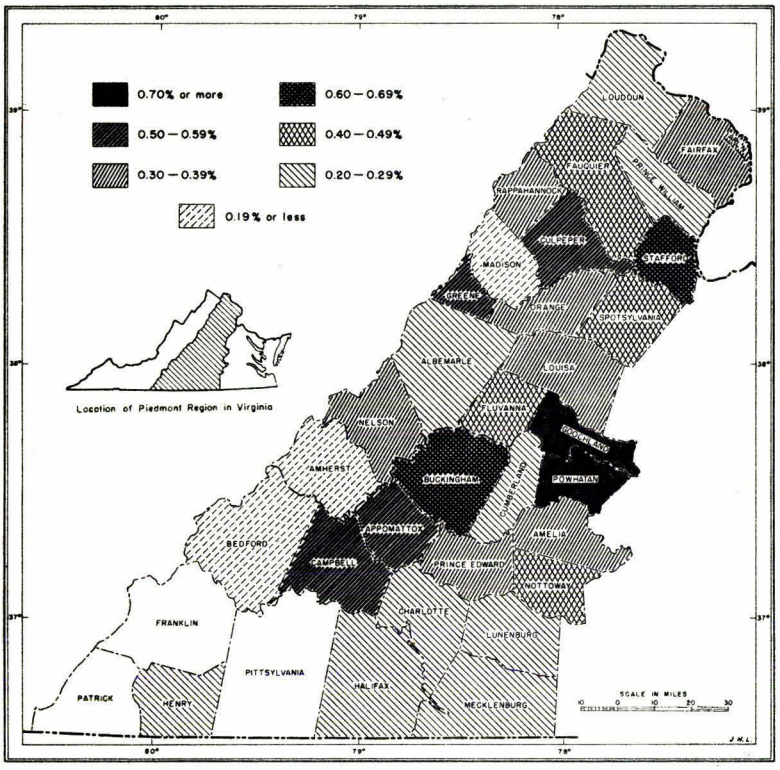

Figure 29. -- Proportion of protected forest land in each county burned annually, 1937-41 (17). (Blank counties not in the State protection system.)

Much needs to be done, also, in educating people on the destructiveness of fire and the necessary precautions to prevent it. A large share of this job falls in the realm of agricultural extension. State leaders in the field of agronomy, especially, should lend their wholehearted support to discouraging the common practice of broomsedge and crop-residue burning, now responsible for such a large share of the forest fires.

Forestry Sections and Their Problems

Piedmont Virginia may be subdivided into a number of sections, each more or less distinct with respect to land and forest conditions and the relationships of forestry to general economic activity (see fig. 30). While most of these sections have the major forest problems of fire, destructive cutting, and inefficient utilization and marketing, each of them has additional problems peculiar to itself. A description of the forestry situation in these sections is helpful to an understanding of the needs of forestry in the Piedmont as a whole.

Mountain Hardwoods Section

The Mountain Hardwoods Section of the Piedmont, comprising some 880,000 acres of land, includes the narrow strip of rugged, heavily wooded Blue Ridge Mountains along the western border. Here are some of the most productive hardwood sites in the Blue Ridge: the coves and eastern slopes. But fire, destructive cutting, and the inroads of chestnut blight have reduced most timber stands to a condition requiring many decades of management to remedy.

Figure 30. -- Forestry sections of Piedmont Virginia.

On the other hand, the people of the section have pressing need for the income which managed forests can offer. Lands are typically steep and poorly suited to agriculture, and while there is some successful fruit farming in the foothill coves, a bare subsistence farming is the general rule. Considering the limited potentialities of other resources, it is evident that the forest resource holds chief promise of providing badly needed cash income and better living.

Excellent markets at nearby Lynchburg, Martinsville, Rocky Mount, Waynesboro, Front Royal, and other centers offer outlets for a wide variety of forest products -- pulpwood, veneer logs, chestnut extract wood, sawlogs, cooperage bolts, and ties. But depleted growing stock and a poor system of secondary roads cancel much of the advantage which would otherwise stem from these good markets.

A public-works program of resource rehabilitation is one answer -- first, to create eventually a productive forest serviced by an adequate system of roads; second, to provide employment during the intervening period of waiting; third, to enhance the watershed and recreational values of the forest, important in this section; fourth, to provide for

the local workers a practical education in the care and conservation of their forests. This program should be attended by considerable enlargement of public land holdings managed for timber production to promote the welfare of local communities.

The logical time for inaugurating such a program is at the close of the war, when many of the people who have migrated to industrial centers may return, to aggravate the pressure of population upon resources.

Southwestern Foothills Section

The Southwestern Foothills Section of the Piedmont, an area of 970,000 acres, is typified by scattered farm woodlands, with a few more extensive forest tracts (fig. 31).[5/]

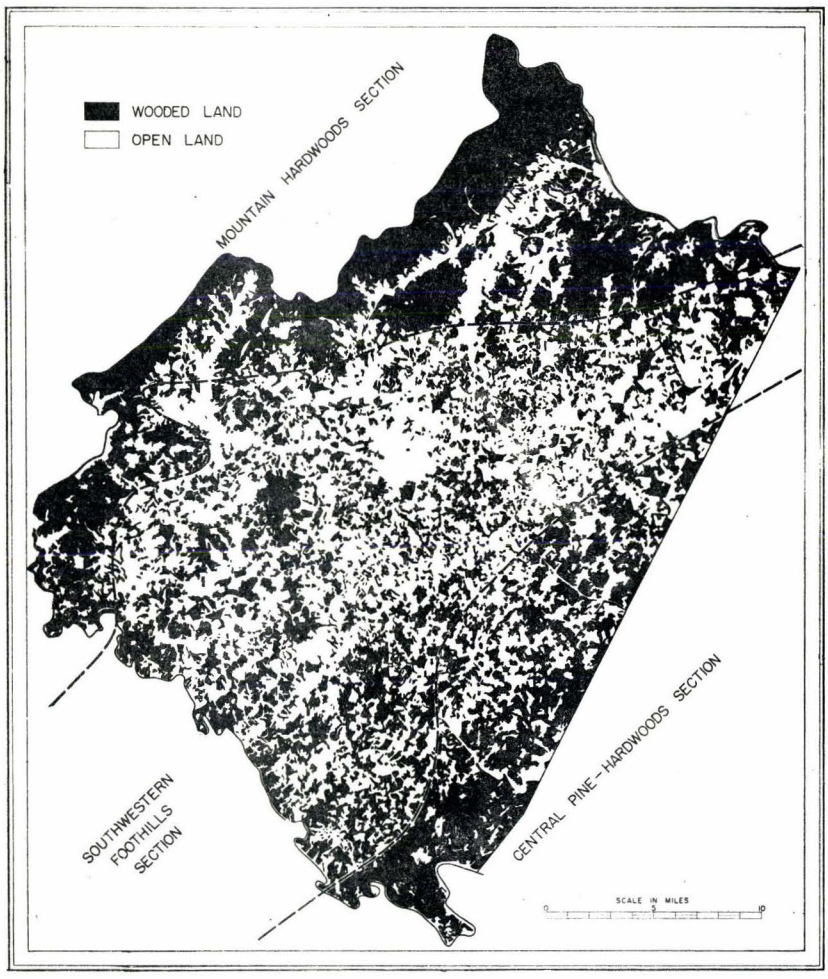

Figure 31. -- Location of wooded lands in Bedford County, Virginia.

Most of the land is poorly suited to farming, and woods and sawmill work is a vital source of cash income to the subsistence farmers of the section. Many of the rural workers, however, turn to employment in the industrial centers -- Lynchburg, Bedford, Rocky Mount, Bassetts, and Martinsville -- as a major source of income, conducting their farming or timber operations as a side-line on a part-time basis. Expanding industries, including several wood-using industries, permit a fairly satisfactory level of living to a rather dense population.

5/ Figures 31, 32, and 33 are based upon maps made under direction of the Virginia State Committee on Agricultural Programs, as part of the project in county agricultural planning.

The productivity of woodlands has been greatly reduced by fires, which have probably caused greater damage in this section than anywhere in Virginia east of the Blue Ridge. Well over a third of the section lies within counties not belonging to the State fire-protection system. The fire situation will be greatly improved when these counties are brought into the system.

Another destructive element threatening forest support to industrial expansion is the multitude of small sawmills that for years have been overcutting the timber. The need is particularly great in this section for introducing more efficient methods and equipment among small-mill operators.

In the northern part, where hardwood timber predominates and many of the farms raise cattle for milk and beef, damage to the woods through grazing is serious. In the southern part, the forests run heavily to pine -- mostly old-field Virginia pine. Introduction and encouragement of shortleaf pine through planting and stand management would greatly increase forest productivity.

Soil washing and gullying have severely damaged the heavily rolling erodible lands of the section. While the steepest hillsides have now been retired to forest, erosion is still active or threatening on all but the small acreage of fairly level crop land.

Estate Woodlands Section

The Estate Woodlands Section is an area of rather good agricultural soils and large farms, and, on the whole, of progressive land management. Its 1,750,000 acres are largely in pasture and crops, with hardwood and hardwood-pine woodlands dotted here and there among the farms.

Dairying, beef-cattle production, and fruit growing are the chief types of commercial agriculture. Besides the commercial farms, a great and increasing share of the land is in large estates, operated mostly as stock farms by persons whose source of livelihood is in Washington, Baltimore, and other urban centers to the east and north. The prevalence of stock raising and the use of woodlands for pasture result in much serious damage to the stands of hardwood timber. The disconnected character of woodlands, on the other hand, minimizes the danger of widespread fires.

On the estates, the chief motives in land management are aesthetic rather than monetary. Timber stands are managed so as to enhance their appearance, with production of material forest products a secondary consideration. On commercial farms, because of the restricted size of woodlands, the principal value of the timber is in furnishing materials for use on the farms themselves: fuel wood, fence posts, and repair lumber.

Washington Suburban Section

In the Washington Suburban Section, comprising some 210,000 acres, the use of land for residential purposes and for urban business takes

precedence over other uses. Woods are relatively unimportant as a source of income.

Central Pine-Hardwoods Section

The central Pine-Hardwoods Section is characterized by the poverty of its soil, its forests, and its people. Its 3,440,000 acres (more than one-third of all land in Piedmont Virginia) contain a large proportion of woodland. This woodland represents the regional extreme of poor stocking and of small size and inferior quality of timber.

Particularly in the north, the line of division between the Central Pine-Hardwoods Section and that to the west is remarkably distinct. East of this line are the poor Tatum and Nason soils, supporting a predominantly pine forest, with short-boled hardwoods in mixture, and permitting only a meager development of farming. West of this line the superior Davidson soils predominate, with a larger proportion of open farm land (fig. 32) and distinctly taller hardwood timber.

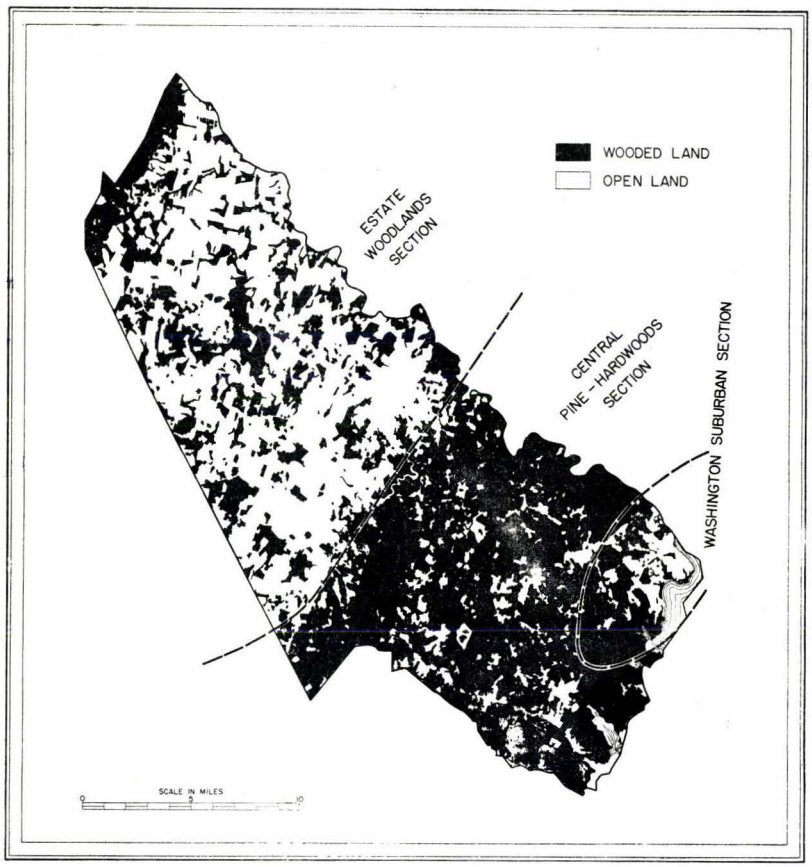

Figure 32. -- Location of wooded lands in Prince William County, Virginia.

It is in this section that the problem of hardwood invasion of pine stands assumes its most serious form. In an economy constructed around the utilization of softwoods, the stabilization of agriculture and the heavy cutting of pine for pulpwood and sawlogs are rapidly increasing the proportion of hardwoods, which are much less productive than pine on these infertile soils and which find their chief use as fuel wood.

In fact, it is to be feared that the section may attain the quantity of hardwoods of the western sections, but without their favorable growing conditions and markets. At the same time, the Central Section is comparable to the Estate Woodlands Section in farm population, but lacks the latter's agricultural soils. And it resembles the Southwestern

Foothills Section in its depleted forests, but has no similar industrial development to serve as an outlet for surplus labor. The Central Pine-Hardwoods Section has most of the forestry problems, and few of the saving graces, of the remainder of Piedmont Virginia.

Despite over-cutting, burning, and other forms of abuse, the forest resource remains the heart of the economic life of the people, and the continuing abandonment of farm land throughout the section promises to increase the relative importance of forestry. In several counties, well over a fourth of all income received by the people arises in harvesting, transporting, and manufacturing forest products. In one county, the value of forest products is more than twice the value of all farm crops and livestock products. The level of this income, however, is too low to provide a satisfactory living. Beyond the reasonable possibilities of farm-population adjustment, that level can be raised materially only by increasing the contribution of forests and forest industries.

The Central Pine-Hardwoods Section illustrates more forcibly than any other section of Piedmont Virginia the need for legislative control of the use of forest resources. There appears to be little hope of arresting exploitation and building up productivity on private lands by other means. Such legislation should be preceded and supported by an intensive program of education.

The Virginia Forest Service administers some 40,000 acres of land in the section (virtually all the State Forest lands), and has designated an additional 380,000 acres as suitable for purchase. This land should be acquired both to build a backbone of productive forest within the section and to place permanently beyond the reach of agriculture those poorest lands upon which farming inevitably fails. The latter policy could be strengthened by a supplementary program of land-use classification and zoning.

Some forest land has been so denuded by cutting and burning that replanting of trees is believed by many to be the only efficient way to rehabilitate it. The Virginia Forest Service is of the opinion that some 250,000 acres of land in the Piedmont require planting; a large share of this land lies within the Central Section.

The problems of the section also call for an enlarged program of research bearing upon silvicultural and economic aspects of forestry. How to combat hardwood conversion, or perhaps in some measure to adapt utilzation to the trend in hardwoods, is a pressing question. But the fundamental question concerns the productivity of forest lands in the section -- what is land worth under forest management; what population can it reasonably support?

Southern Flue-Wood Section

In the Southern Flue-Wood Section, comprising some 2,450,000 acres, production of flue-cured, or bright-fired, tobacco overshadows other farm enterprises and places a large burden upon the forests to produce the wood

required for tobacco curing. This drain is in addition to the heavy drain for ordinary fuel wood and for pine lumber and pulpwood.

While less heavily wooded than the Central Pine-Hardwood Section, the Southern Flue-Wood Section nevertheless is comprised in large measure of forested land -- chiefly stands of the shortleaf-pine type occurring as small, isolated woodlands on each farm (fig. 33).

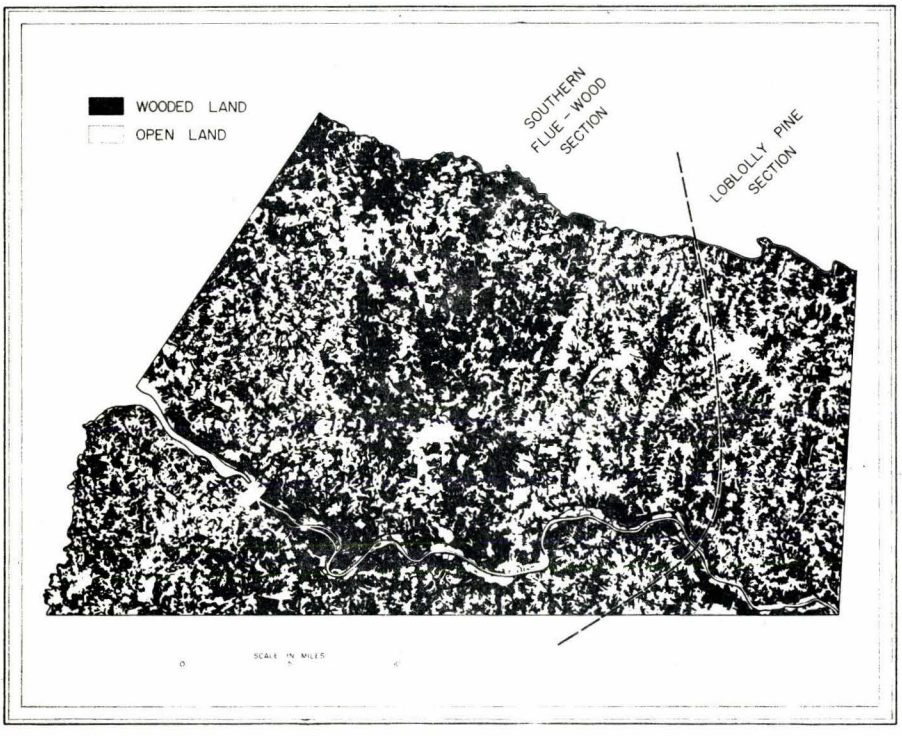

Figure 33. -- Location of wooded lands in Mecklenburg County, Virginia.

The heavy demand for forest products of all types had produced a higher rate of drain in proportion to growing stock in this section than in any other in Piedmont Virginia and has led to a marked scarcity of timber in many localities. This, in turn, has resulted in a more general recognition of the value of timber than is to be found elsewhere in the Piedmont.

Since it requires about 2-1/2 cords of wood to cure the crop harvested from each acre of tobacco land, and since returns under management in the near future promise to average about one-half cord per acre per year, it is necessary for the self-sufficient farm to have in woodland, for flue-wood alone, about 5 times its tobacco acreage. Adding to this the farm needs for fuel wood, fence posts, and repair lumber, it appears that the average tobacco farm now requires 45 acres of woods in fair condition to supply all home needs for forest products. With the typical size of farm woodlands in the section ranging between 40 and 50 acres, the chief function of woodlands for the present should apparently be to supply wood for the farm itself: only the larger and more productive tracts may properly be expected to yield cash income. In this light, the extent to which woods depletion is resulting from the heavy cut of lumber within the section (see fig. 25) is particularly apparent.

Tobacco production creates several other special forestry problems within the section. Tobacco plant beds are customarily located in the woods, and the clearings made for this purpose should subsequently be given careful management to prevent their lying idle for years under the cover of brush which generally takes possession of the ground. More

important is the problem of tenancy, considerably more prevalent in this section than elsewhere in Piedmont Virginia. More than half of all farms are operated by tenants. It is customary for tenants to cut their flue and fuel wood from the farm forest, but seldom is any restriction placed upon the manner of cutting -- either in the lease or through supervision. Unrestricted, and having no interest in the woods as a continuing resource, the tenant cuts those trees most easily made into fire wood -- usually the straightest, least limby, and therefore most valuable pines, which show the greatest promise for higher uses. A program of timber marking for fire-wood cuttings, perhaps managed and financed cooperatively by landlords, would do much to alleviate this problem.

In the eastern part of the section, where the shortleaf-pine forests predominate, depleted fields are being invaded by Virginia pine, at great loss of forest productivity. How to check the spread of this inferior pine is an important question.

Loblolly Pine Section

The Loblolly Pine Section, embracing a narrow strip of about 370,000 acres in six of the southeastern counties, forms the western edge of the extensive pine lands of eastern Virginia. Heavily forested, and containing the best pine sites in the Piedmont, the section is nevertheless of secondary importance as a part of the Piedmont because of its restricted area. Its forestry conditions and problems are largely those of the loblolly-pine lands of the Coastal Plain.

Activities of Public & Private Agencies

A number of agencies, public and private, are now conducting programs of action and research in forestry in Piedmont Virginia.

Nine pulp mills operate in the State, all of them drawing some wood from the Piedmont. Of these, four have active forestry departments (all but one organized since 1939) which manage company lands and give management advice and assistance to private owners from whom they purchase pulpwood.

The Virginia Forest Service engages in four major lines of activity: (1) Fire protection, about 85 percent of the State Forest Service work. The cooperative Federal-State-county protection system is extended to 32 of the Piedmont's 35 counties, with another county to be added in 1944 on the basis of increased appropriations received for the present biennium. (2) Management of State forests, not yet fully under way. In addition, the Forest Service administers several small county forests in the district. (3) Directing work of the State camps of the Civilian Conservation Corps (an activity now suspended) and maintaining CCC improvements, particularly fire roads, trails, and telephone lines. (4) Giving management advice and assistance to private non-farm forest owners. One man is normally assigned to work throughout the State. The Forest Service also maintains a Clarke-McNary nursery distributing at cost about 2 million tree seedlings per year for forest planting.

In the field of formal education, both the University of Virginia and the Virginia Polytechnic Institute conduct forestry courses. The latter has recently set up a one-term course in general forestry as a requirement for the degree in agriculture.

The State Agricultural Extension Service, through the Extension Forester, carries a program of education and technical assistance to farm-woodland owners, helping them with all phases of timber management and marketing. During the past decade it has made considerable progress in promoting forestry-mindedness among farmers and county agricultural agents, stimulating many of these agents to undertake constructive forestry programs in their counties.

The Virginia State Planning Board has made general surveys of the forestry situation in connection with its reports on natural resources, agriculture, and industry. At present it is the coordinating agency in a joint project with the State University and Agricultural College -- a project aimed at land-use classification and a related study of population and small industry, and thus having a close bearing upon forestry problems.

The U. S. Soil Conservation Service is the administrative agency in the soil conservation districts, organized in accordance with the State enabling act of 1938. Twenty-two of the Piedmont's 35 counties are now in conservation districts. Farm-management plans, including the woods in more or less detail, are prepared for cooperating farms. In one district a technical forester prepares detailed woods-management plans for a limited number of cooperators and advises them on timber cutting and marketing. Through its C.C.C. camps the Soil Conservation Service has conducted cutting and improvement operations and set up demonstrations in private woodlands. It maintains nurseries and distributes forest planting stock to cooperators.

The U. S. Forest Service administers two national forests in the Mountain Hardwoods Section of the region. These forests include 85,000 acres within the section, with a gross purchase-unit area of 223,000 acres: more than a fourth of the section's total area. Through the Appalachian Forest Experiment Station it conducts research in forest management, fire control, forest-water relationships, and some of the economic aspects of timber supply, production, and industrial uses. It maintains the Lee Experimental Forest in Buckingham County as a field research laboratory and as a going demonstration in the business of forest management.

The Tennessee Valley Authority cooperates with a number of farmers in Piedmont Virginia as a part of its phosphate-fertilizer demonstration program. Plans prepared for these farms in some cases consider the place of the woodland in the farm business and contain a few general recommendations for woods management.

The Farm Security Administration, also, gives some attention to the needs of farm forestry on its clients' farms. It is currently

preparing for more intensive work in the forestry field and is cooperating with the U. S. Forest Service in giving to its county supervisors a brief schooling in practical forestry.

The Agricultural Adjustment Administration recognizes tree planting and forest-stand improvement as soil-conserving practices. In 1940 it provided a special allotment of $30 per farm which could be earned through forestry practices. (This allotment was subsequently reduced to $15, and then eliminated, but payments out of the general allotment are still obtainable on the same basis as before 1940). Farmers' response has, on the whole, been meager. During the 6-year period 1936-41, an average of only 220 acres was planted annually in the entire district, and an average of only 35 acres of woods improved.

From a review of the forestry activities of these agencies it appears that with only one or two outstanding exceptions the essential framework of a sound forestry program is already well developed. The chief need along these lines is for an increased tempo of activity -- an objective now, of course, largely to be postponed until after the war. In the field of extension and technical assistance 3 or 4 men now serve on a part-time basis where probably at least 10 full-time workers are needed to do an effective job. The State fire-protection system, left over-expanded by retirement of the Civilian Conservation Corps, greatly needs strengthening, and general educational programs in fire prevention also require considerable enlargement.

A number of agencies dealing with the farm as a business unit are apparently beginning to give some attention to the farm woods. There is little evidence, however, that they regard farm forestry as an integral and productive part of the farm business. Methods of appraisal and of farm budgeting largely ignore the existence of the woodland. In Piedmont Virgnina, with its great aggregate of non-agricultural soils and its economic future so closely dependent upon the future of forest labor and industry, it is difficult to see how these agencies can make real progress toward their objective of social betterment without coming definitely to grips with the forestry situation.

Two important fields of forestry activity have so far seen scanty progress. The first is public regulation of cutting practices. As regards State action, the General Assembly of Virginia has in committee considered the need for such legislation but has to date merely evolved two rather ineffective seed-tree laws. The second neglected field is that of the distribution of forest products. While marketing problems can be fully met only after some regeneration of the forest resource, measures can be taken now to improve the situation. Furthermore, research in forest-products distribution is urgently needed to uncover all the facts and provide a basis for a well-rounded program.

Recommendations in Summary

The following, then, appear to be the outstanding needs of the forest situation in Piedmont Virginia:

A. Education and technical assistance in forestry.
   1. To promote forestry-mindedness among the people.
   2. To combat carelessness with fire.
   3. To increase the effectiveness of public forest regulation, when adopted.
   4. To give concrete assistance to woods owners in --
      a. Developing forest-management plans.
      b. Estimating timber volumes and marking timber for cutting
      c. Marketing forest products.
   5. To promote increased efficiency and better utilization in small sawmills.

B. Public control of timber-cutting practices.
   1. To stop forest exploitation.
   2. To permit rebuilding the forest as a source of income
   3. To lay foundations for increasing the efficiency of timber marketing.

C. Public forest acquisition.
   1. By the State, an estimated 380,000 acres east of the foothills.
   2. By the Federal government, an estimated 140,000 acres in the Mountain Section.

D. Forest research.
   1. To develop economic methods of forest management, aimed at producing trees favored commercially
   2. To evaluate present and potential contribution of forests to local income as a basis for planning needed population and land-use adjustments.
   3. To study the problems of timber marketing and suggest means of solving them.
   4. To provide in part the facts needed in land-use classification and zoning.

E. Resource rehabilitation through public works.
   1. To provide post-war employment.
   2. To create a permanently productive forest.
   3. To give practical education in forest conservation.

F. Other public forestry measures.
   1. Intensification of forest-fire protection.
   2. Rehabilitation, possibly through forest planting, of about 250,000 acres, to reclaim idle land and arrest soil erosion.

3. Credit extension to woodland owners to make conservative cutting financially possible.
4. Greater attention to farm forestry on the part of agricultural extension and service agencies.

G. Private forestry measures.
1. Steps by pulp and lumber companies and concentration yards to correct remediable defects in their buying practices so as to promote better forestry practice and higher forest income.
2. Action by landlords to clarify wood-cutting privileges and requirements on tenant farms, and by other owners to encourage sound cutting practices on their woodlands.

Many of these forestry measures are to be regarded as part of a post-war program. Aims in that period would be, first, to provide useful employment for persons released from war activities; second, to rebuild a productive forest resource, depleted through two centuries of mismanagement and currently undergoing especially severe strain because of the war itself.

Modern war places the heaviest of demands upon all natural resources. High prices and enlarged requirements for pulpwood, sawlogs, ties, and other forest products call urgently for maximum timber production, even in a region like Piedmont Virginia, whose impoverished forests were already overburdened to the limit. War has not only accelerated cutting but it has also led to an increase in undesirable cutting practices -- heavier cutting of forest stands and the lowering of requirements standards by wood-using industries.

During the past war Piedmont forests were called upon for a similar, though less extreme, effort of production. They emerged heavily scarred from that conflict. They have entered the present war less well prepared than before to furnish the timber so urgently needed. They will undoubtedly emerge from this war in a still less productive condition. Very little can be done now to alter the fact of forest impoverishment. But in the post-war period something can and must be done. The forests of Piedmont Virginia must be better prepared to meet the demands of future emergencies. But in addition, and even more important, they must be equipped to provide the people of the district with decent levels of employment and income in the years of peace.

Section 5. -- APPENDIX

Glossary

Forest Type

Softwood types (loblolly pine-, shortleaf pine-, Virginia pine-, white pine-, and redcedar-hardwoods). -- Stands in which softwoods comprise 25 percent or more of the number of dominant and codominant trees, with the designated softwood species predominating. In the appendix tables, statistics for the white pine-and redcedar-hardwoods types are included with those for the cove-hardwoods and shortleaf pine-hardwoods types, respectively.

Bottomland hardwoods. -- Stands in which hardwoods make up more than 75 percent of the number of dominant and codominant trees; usually found along stream margins and river bottoms.

Cove hardwoods. -- Stands in which yellowpoplar and other hardwoods make up more than 75 percent of the number of dominant and codominant trees; usually found on lower mountain slopes and coves with northerly or easterly exposure.

Upland hardwoods. -- Stands in which mixed oaks and other hardwoods make up more than 75 percent of the number of dominant and codominant trees; usually found on rolling, upland sites.

Diameter

Tree diameter. -- Diameter outside bark, in inches, measured 4-1/2 feet above ground.

Diameter class. -- Includes a 2-inch range of tree diameters. The 10-inch diameter class includes trees from 9.0 to 10.9 inches in diameter; the 12-inch class, trees from 11.0 to 12.9 inches, and so on.

Tree Classification

Sound, sawlog-size tree. -- A softwood tree 9.0 inches or more in diameter, or a hardwood tree 13.0 inches or more, with not less than one sound 12-foot butt log, or with 50 percent of the gross board-foot volume of the tree in usable sawlogs.

Sound tree under sawlog size. -- Any sound, straight-stemmed tree between 1.0 inch in diameter and sawlog size.

Cull tree. -- A tree which -- because of poor form, limbiness, rot, or other defect -- fails to qualify as a sound tree.

Pole tree. -- A pine tree that will produce a pole conforming to specifications of the American Standards Association.

Forest Condition

Old-growth saw-timber stand. -- A stand having the characteristics of the original mature timber of the region, containing at least 1,000 board feet of sawlogs per acre in the case of hardwood types, 600 board feet in the case of softwood types.

Second-growth saw-timber stand. -- A stand of second growth containing at least 600 board feet per acre.

Cordwood stand. -- A stand of second growth containing less than 600 board feet per acre.

Reproduction stand. -- A nonsawtimber, non-cordwood stand containing at least 80 well distributed seedlings per acre. Statistics for this condition include those for the clear-cut condition -- i.e., cut-over areas having insufficient young growth to qualify as either cordwood or reproduction.

Volume

Board-foot volume. -- The volume by International 1/4-inch rule, exclusive of defect, of that portion of living, sound, sawlog-size trees lying between stump and the upper limit of merchantability for sawlogs.

Volume in cords. -- The volume of wood and bark in standard cords, exclusive of defect, of that portion of living trees 5.0 inches and larger in diameter lying between stump and a top of approximately 4 inches minimum diameter outside bark.

Cubic-foot volume. -- The solid cubic volume of all wood (not bark) included in the cordwood estimate.

Growth and Utilization

Growing stock. -- The volume of timber exclusive of cull trees and hardwood tops.

Mortality. -- The volume lost from the growing stock through the death of trees, caused by fire, tree competition, disease, insect damage, and windthrow.

Net growth. -- The net increase (mortality deducted) in growing stock, before subtracting commodity drain.

Commodity drain. -- The reduction in growing stock due to cutting within the designated area.

Production. -- The volume of forest products manufactured or consumed by forest industry within the designated area.

Forest Survey Unit

Northern Piedmont. -- Unit No. 3, comprised of the Piedmont counties situated north of the James River (see fig. 1).

Southern Piedmont. -- Unit No. 2, comprised of the Piedmont counties situated south of the James River (see fig. 1).

Table 11. -- Land area by type of use, 1940

Type of use	Area in acres			Percent of total land area		
	Entire Piedmont	Northern Piedmont	Southern Piedmont	Entire Piedmont	Northern Piedmont	Southern Piedmont
Forest land:						
Commercial forest....	5,827,900	2,405,900	3,422,000	57.9	54.4	60.7
Reserved public forest	104,300	98,100	6,200	1.0	2.2	.1
All forest land....	5,932,200	2,504,000	3,428,200	58.9	56.6	60.8
Non-forest land:						
Active farm land:						
Pasture.....	1,064,700	702,500	362,200	10.6	15.9	6.4
Crop land and other farm land.....	2,621,300	1,014,300	1,607,000	26.0	22.9	28.5
All active farm land	3,686,000	1,716,800	1,969,200	36.6	38.8	34.9
Abandoned farm land...	220,400	93,700	126,700	2.2	2.1	2.2
Other non-forest land.	227,900	109,800	118,100	2.3	2.5	2.1
All non-forest land.	4,134,300	1,920,300	2,214,000	41.1	43.4	39.2
All land.....	10,066,500	4,424,300	5,642,200	100.0	100.0	100.0

Table 12. -- Forest area by forest type and condition, 1940

ENTIRE PIEDMONT

Forest type	All conditions		Saw-timber stands		Cordwood stands	Reproduction stands
			Old growth	Second growth		
	Acres	Percent	Acres	Acres	Acres	Acres
Loblolly pine-hardwoods..	96,400	1.6	.....	49,500	31,600	15,300
Shortleaf pine-hardwoods.	1,233,100	21.2	11,300	670,300	480,700	70,800
Virginia pine-hardwoods..	1,391,500	23.9	2,400	472,100	731,200	185,800
Bottom-land hardwoods....	334,100	5.7	10,400	182,100	129,600	12,000
Cove hardwoods.....	185,700	3.2	6,300	116,600	62,800	.....
Upland hardwoods.....	2,587,100	44.4	73,200	1,116,500	1,272,100	125,300
All types.....	5,827,900	.....	103,600	2,607,100	2,708,000	409,200
	.....	100.0	1.8	44.7	46.5	7.0

NORTHERN PIEDMONT

			Acres	Acres	Acres	Acres
Loblolly pine-hardwoods..	7,100	.3	.....	2,400	3,200	1,500
Shortleaf pine-hardwoods.	245,700	10.2	1,600	120,500	103,100	20,500
Virginia pine-hardwoods..	639,500	26.6	1,600	198,400	353,600	85,900
Bottom-land hardwoods....	148,100	6.1	5,500	73,300	63,000	6,300
Cove hardwoods.....	110,200	4.6	4,700	62,200	43,300	.....
Upland hardwoods.....	1,255,300	52.2	49,600	521,300	639,500	44,900
All types.....	2,405,900	.....	63,000	978,100	1,205,700	159,100
	.....	100.0	2.6	40.7	50.1	6.6

SOUTHERN PIEDMONT

			Acres	Acres	Acres	Acres
Loblolly pine-hardwoods	89,300	2.6	.....	47,100	28,400	13,800
Shortleaf pine-hardwoods.	987,400	28.9	9,700	549,800	377,600	50,300
Virginia pine-hardwoods..	752,000	22.0	800	273,700	377,600	99,900
Bottom-land hardwoods....	186,000	5.4	4,900	108,800	66,600	5,700
Cove hardwoods.....	75,500	2.2	1,600	54,400	19,500	.....
Upland hardwoods.....	1,331,800	38.9	23,600	595,200	632,600	80,400
All types.....	3,422,000	.....	40,600	1,629,000	1,502,300	250,100
	.....	100.0	1.2	47.6	43.9	7.3

Table 13. -- Species composition of forest types, 1940[1/]

Tree species	All forest types	Loblolly pine hardwoods	Shortleaf pine hardwoods	Virginia pine hardwoods	Bottomland hardwoods	Cove hardwoods	Upland hardwoods
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Softwoods:							
Loblolly pine.....	1.6	64.4	.8	.2	.6	.....	.2
Shortleaf pine....	19.0	8.5	63.5	9.7	2.3	1.4	3.7
Virginia pine.....	14.4	.8	7.3	60.9	1.0	2.0	2.2
White pine,hemlock	.7	.....	.1	.4	.1	8.9	.4
Redcedar.....	.3	.1	.7	.4	.2	.1	.2
All softwoods...	36.0	73.8	72.4	71.6	4.2	12.4	6.7
Hardwoods:							
Northern red oak..	3.7	.1	.9	.7	2.1	6.6	6.5
Other red oaks....	10.3	3.2	6.1	6.1	5.7	5.0	16.3
White oak.....	13.2	3.3	4.7	5.3	3.8	5.3	24.3
Chestnut oak.....	5.2	.....	.6	.5	.1	4.3	11.1
Other white oaks..	1.4	.8	1.2	1.4	.7	.5	1.9
Red maple.....	2.1	1.0	.9	.9	7.4	2.3	2.5
Black tupelo.....	1.6	1.0	.6	.8	1.2	2.0	2.6
Sweetgum.....	3.7	9.4	3.5	1.6	16.4	.2	2.7
Yellowpoplar.....	11.2	4.5	5.7	7.2	15.1	45.4	11.6
Beech.....	.8	.1	.1	.1	.9	.6	1.5
Hickory.....	4.0	.5	1.3	1.3	1.3	3.6	7.4
Ash.....	1.1	.2	.2	.2	8.1	1.9	.6
Scrub hardwoods...	.8	.2	.4	.6	.8	1.5	1.0
Other hardwoods...	4.9	1.9	1.4	1.7	32.2	8.4	3.3
All hardwoods...	64.0	26.2	27.6	28.4	95.8	87.6	93.3
All species.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1/] Cubic-foot volume in each species, expressed as a percentage of the total volume for the type -- average of all stands sampled in Piedmont Virginia.

Table 14. -- Saw-timber volume -- International $\frac{1}{4}$-inch Scribner, and Doyle rules -- by tree species, 1940

ENTIRE PIEDMONT

Tree species	International $\frac{1}{4}$-inch rule	Scribner rule	Doyle rule
	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:			
Shortleaf and loblolly pines	1,973,900	1,631,600	1,005,200
Virginia pine	1,058,400	858,600	497,600
Other softwoods	116,600	100,000	70,300
All softwoods	3,148,900	2,590,200	1,573,100
Hardwoods:			
Northern red oak	437,700	402,600	341,100
Other red oaks	686,500	623,300	497,100
White oaks	1,261,700	1,148,800	931,100
Red maple	108,400	97,800	75,500
Sweetgum	243,300	219,300	168,600
Yellowpoplar	1,002,200	908,000	715,700
Hickory	254,600	229,900	177,900
Other hardwoods	467,100	422,500	329,700
All hardwoods	4,461,500	4,052,200	3,236,700
All species	7,610,400	6,642,400	4,809,800

Table 15.-- Saw-timber volume, International $\frac{1}{4}$-inch rule, by tree species and forest condition, 1940

ENTIRE PIEDMONT

Tree species	All conditions		Saw-timber stands		Cordwood and reproduction stands
			Old growth	Second growth	
	M bd. ft.	Percent	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Loblolly pine.....	220,000	2.9	200	215,100	4,700
Shortleaf pine.....	1,753,900	23.1	88,000	1,557,800	108,100
Virginia pine.....	1,058,400	13.9	10,100	956,600	91,700
Other softwoods....	116,600	1.5	13,300	94,700	8,600
All softwoods....	3,148,900	41.4	111,600	2,824,200	213,100
Hardwoods:					
Northern red oak...	437,700	5.8	91,900	338,800	7,000
Other red oaks.....	686,500	9.0	61,800	587,800	36,900
White oak.....	843,300	11.1	146,200	659,600	37,500
Chestnut oak.....	353,200	4.6	76,200	257,600	19,400
Other white oaks...	65,200	.9	2,000	58,200	5,000
Red maple.....	108,400	1.4	6,800	94,200	7,400
Black tupelo.....	78,800	1.0	4,100	70,300	4,400
Sweetgum.....	243,300	3.2	29,200	204,200	9,900
Yellowpoplar.....	1,002,200	13.2	28,100	935,800	38,300
Beech.....	62,100	.8	4,900	53,800	3,400
Hickory.....	254,600	3.3	21,300	217,800	15,500
Ash.....	54,700	.7	9,300	42,400	3,000
Other hardwoods....	271,500	3.6	35,400	223,800	12,300
All hardwoods....	4,461,500	58.6	517,200	3,744,300	200,000
All species.....	7,610,400	100.0	628,800	6,568,500	413,100

Table 15. -- Saw-timber volume, International $\frac{1}{4}$-inch rule, by tree species and forest condition, 1940 -- Continued

NORTHERN PIEDMONT

Tree species	All conditions		Saw-timber stands		Cordwood and reproduction stands
			Old growth	Second growth	
	M bd. ft.	Percent	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Loblolly pine	13,500	.5	200	13,300	.....
Shortleaf pine	312,800	11.3	8,600	272,300	31,900
Virginia pine	454,300	16.4	4,200	405,200	44,900
Other softwoods	57,100	2.0	13,200	40,700	3,200
All softwoods	837,700	30.2	26,200	731,500	80,000
Hardwoods:					
Northern red oak	242,100	8.7	60,700	176,200	5,200
Other red oaks	304,100	11.0	42,900	241,600	19,600
White oak	414,800	15.0	84,900	309,100	20,800
Chestnut oak	216,100	7.8	60,600	147,000	8,500
Other white oaks	16,700	.6	500	14,000	2,200
Red maple	37,100	1.3	900	33,600	2,600
Black tupelo	31,800	1.1	300	29,800	1,700
Sweetgum	58,100	2.1	5,300	51,000	1,800
Yellowpoplar	364,300	13.2	8,000	341,800	14,500
Beech	24,500	.9	600	22,500	1,400
Hickory	111,700	4.0	7,600	97,800	6,300
Ash	15,700	.6	900	13,700	1,100
Other hardwoods	95,600	3.5	19,100	71,200	5,300
All hardwoods	1,932,600	69.8	292,300	1,549,300	91,000
All species	2,770,300	100.0	318,500	2,280,800	171,000

Table 15. -- Saw-timber volume, International $\frac{1}{4}$-inch rule, by tree species and forest condition, 1940 -- Continued

SOUTHERN PIEDMONT

Tree species	All conditions		Saw-timber stands		Cordwood and reproduction stands
			Old growth	Second growth	
	M bd. ft.	Percent	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Loblolly pine.....	206,500	4.3	.....	201,800	4,700
Shortleaf pine.....	1,441,100	29.8	79,400	1,285,500	76,200
Virginia pine.....	604,100	12.5	5,900	551,400	46,800
Other softwoods.....	59,500	1.2	100	54,000	5,400
All softwoods.....	2,311,200	47.8	85,400	2,092,700	133,100
Hardwoods:					
Northern red oak....	195,600	4.0	31,200	162,600	1,800
Other red oaks.....	382,400	7.9	18,900	346,200	17,300
White oak.....	428,500	8.9	61,300	350,500	16,700
Chestnut oak.....	137,100	2.8	15,600	110,600	10,900
Other white oaks....	48,500	1.0	1,500	44,200	2,800
Red maple.....	71,300	1.5	5,900	60,600	4,800
Black tupelo.....	47,000	1.0	3,800	40,500	2,700
Sweetgum.....	185,200	3.8	23,900	153,200	8,100
Yellowpoplar.....	637,900	13.2	20,100	594,000	23,800
Beech.....	37,600	.8	4,300	31,300	2,000
Hickory.....	142,900	2.9	13,700	120,000	9,200
Ash.....	39,000	.8	8,400	28,700	1,900
Other hardwoods.....	175,900	3.6	16,300	152,600	7,000
All hardwoods.....	2,528,900	52.2	224,900	2,195,000	109,000
All species.....	4,840,100	100.0	310,300	4,287,700	242,100

Table 16. -- Saw-timber volume, International $\frac{1}{4}$-inch rule, by tree species and diameter class, 1940

ENTIRE PIEDMONT

Tree species	Diameter class (inches)				
	All classes	10-12	14-18	20-24	26 and larger
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Softwoods:					
Shortleaf and loblolly pines	1,973,900	1,217,300	643,500	101,100	12,000
Virginia pine	1,058,400	786,500	265,200	6,700	.....
Other softwoods	116,600	47,500	36,500	20,300	12,300
All softwoods	3,148,900	2,051,300	945,200	128,100	24,300
	Percent	Percent	Percent	Percent	Percent
	100.0	65.1	30.0	4.1	.8
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
Hardwoods:					
Northern red oak	437,700	.....	162,300	138,500	136,900
Other red oaks	686,500	.....	398,700	209,300	78,500
White oaks	1,261,700	.....	682,400	360,400	218,900
Red maple	108,400	.....	76,400	23,000	9,000
Sweetgum	243,300	.....	183,500	40,300	19,500
Yellowpoplar	1,002,200	.....	638,200	288,200	75,800
Hickory	254,600	.....	182,700	53,000	18,900
Other hardwoods	467,100	.....	313,900	115,600	37,600
All hardwoods	4,461,500	.....	2,638,100	1,228,300	595,100
	Percent	Percent	Percent	Percent	Percent
	100.0	.....	59.1	27.5	13.4
	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
All species	7,610,400	2,051,300	3,583,300	1,356,400	619,400
	Percent	Percent	Percent	Percent	Percent
	100.0	27.0	47.1	17.8	8.1

Table 17. -- Saw-timber volume per acre, International $\frac{1}{4}$-inch rule, by forest type and condition, 1940

ENTIRE PIEDMONT

Forest type	All conditions	Saw-timber stands			Cordwood and reproduction stands
		All	Old growth	Second growth	
	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.
Loblolly pine-hardwoods	2,120	4,050	.....	4,050	80
Shortleaf pine-hardwoods	1,570	2,720	7,510	2,640	140
Virginia pine-hardwoods	950	2,570	6,170	2,550	110
Bottom-land hardwoods	1,750	2,920	7,500	2,660	150
Cove hardwoods	2,500	3,640	7,050	3,460	260
Upland hardwoods	1,200	2,450	5,560	2,240	140
All types	1,310	2,660	6,070	2,520	130

NORTHERN PIEDMONT

Loblolly pine-hardwoods	510	1,500	.....	1,500	.....
Shortleaf pine-hardwoods	1,280	2,440	7,060	2,380	140
Virginia pine-hardwoods	840	2,440	5,940	2,410	110
Bottom-land hardwoods	1,420	2,550	4,820	2,380	150
Cove hardwoods	2,260	3,570	6,660	3,330	240
Upland hardwoods	1,160	2,400	4,840	2,170	130
All types	1,150	2,500	5,060	2,330	130

SOUTHERN PIEDMONT

Loblolly pine-hardwoods	2,250	4,180	.....	4,180	90
Shortleaf pine-hardwoods	1,640	2,780	7,590	2,700	140
Virginia pine-hardwoods	1,050	2,670	6,620	2,660	120
Bottom-land hardwoods	2,000	3,180	10,510	2,850	150
Cove hardwoods	2,850	3,740	8,190	3,600	300
Upland hardwoods	1,240	2,490	7,070	2,310	150
All types	1,410	2,750	7,640	2,630	140

Table 18. -- Volume in cords, by tree species and type of material, 1940

ENTIRE PIEDMONT

Tree species	All types of material		All sound material	Saw-timber trees		Sound trees under sawlog size	Cull trees
				Sawlog material	Upper stems		
	M cords	Percent	M cords	M cords	M cords	M cords	M cords
Softwoods:							
Loblolly pine...	1,024.3	1.4	1,013.0	558.7	132.6	321.7	11.3
Shortleaf pine..	12,460.3	17.1	12,185.6	5,253.8	1,507.7	5,424.1	274.7
Virginia pine...	8,895.6	12.2	7,916.8	2,702.2	872.3	4,342.3	978.8
Other softwoods.	621.4	0.9	587.3	264.1	53.6	269.6	34.1
All softwoods.	23,001.6	31.6	21,702.7	8,778.8	2,566.2	10,357.7	1,298.9
Hardwoods:							
Northern red oak	2,732.7	3.8	2,413.6	1,055.0	663.0	695.6	319.1
Other red oaks..	7,710.9	10.6	6,998.9	1,987.2	1,078.3	3,933.4	712.0
White oak.....	9,553.6	13.1	8,795.8	2,381.2	1,341.2	5,073.4	757.8
Chestnut oak....	4,746.4	6.6	3,779.7	1,112.7	573.5	2,093.5	966.7
Other white oaks	1,309.4	1.8	1,054.5	215.8	108.1	730.6	254.9
Red maple.....	2,191.4	3.0	1,369.9	298.5	171.6	899.8	821.5
Black tupelo....	1,439.9	2.0	1,094.8	232.9	125.7	736.2	345.1
Sweetgum.....	2,650.2	3.7	2,481.1	590.5	351.9	1,538.7	169.1
Yellowpoplar....	8,237.1	11.3	7,663.4	2,707.4	1,470.3	3,485.7	573.7
Beech.....	659.7	0.9	490.2	174.2	103.6	212.4	169.5
Hickory.....	3,122.0	4.3	2,876.1	823.6	434.4	1,618.1	245.9
Ash.....	950.3	1.3	722.5	151.7	80.5	490.3	227.8
Other hardwoods.	4,371.8	6.0	3,081.5	724.0	429.1	1,928.4	1,290.3
All hardwoods	49,675.4	68.4	42,822.0	12,454.7	6,931.2	23,436.1	6,853.4
All species.....	72,677.0	.....	64,524.7	21,233.5	9,497.4	33,793.8	8,152.3
	.....	Percent	Percent	Percent	Percent	Percent	Percent
	.....	100.0	88.8	29.2	13.1	46.5	11.2
Chestnut.....	2,898.5	.....	.....	.....	.....	.....	.....

Table 18. -- Volume in cords, by tree species and type of material, 1940--Continued

NORTHERN PIEDMONT

Tree species	All types of material		All sound material	Saw-timber trees		Sound trees under sawlog size	Cull trees
				Sawlog material	Upper stems		
	M cords	Percent	M cords	M cords	M cords	M cords	M cords
Softwoods:							
Loblolly pine...	57.6	0.2	57.6	34.3	9.1	14.2	.....
Shortleaf pine..	2,672.1	9.2	2,581.9	998.7	301.2	1,282.0	90.2
Virginia pine...	3,962.0	13.6	3,507.6	1,162.4	379.9	1,965.3	454.4
Other softwoods.	268.4	0.9	256.4	129.3	27.9	99.2	12.0
All softwoods	6,960.1	23.9	6,403.5	2,324.7	718.1	3,360.7	556.6
Hardwoods:							
Northern red oak	1,563.7	5.4	1,326.1	587.8	366.9	371.4	237.6
Other red oaks..	3,325.7	11.4	3,008.1	875.4	477.7	1,655.0	317.6
White oak.....	5,058.9	17.4	4,646.6	1,188.1	658.0	2,800.5	412.3
Chestnut oak....	2,753.1	9.5	2,137.7	682.1	352.4	1,103.2	615.4
Other white oaks	490.3	1.7	380.0	57.6	26.9	295.5	110.3
Red maple.....	807.1	2.8	459.0	99.9	58.4	300.7	348.1
Black tupelo....	537.5	1.8	389.3	93.3	50.6	245.4	148.2
Sweetgum.....	730.8	2.5	674.6	142.3	84.2	448.1	56.2
Yellowpoplar....	3,168.3	10.9	2,878.9	983.6	534.6	1,360.7	289.4
Beech.....	300.9	1.0	220.7	69.0	40.9	110.8	80.2
Hickory.....	1,546.0	5.3	1,394.5	369.3	190.4	834.8	151.5
Ash.....	345.7	1.2	234.7	44.1	23.1	167.5	111.0
Other hardwoods.	1,525.1	5.2	1,093.3	253.6	151.1	688.6	431.8
All hardwoods	22,153.1	76.1	18,843.5	5,446.1	3,015.2	10,382.2	3,309.6
All species.....	29,113.2	.....	25,247.0	7,770.8	3,733.3	13,742.9	3,866.2
			Percent	Percent	Percent	Percent	Percent
	.....	100.0	86.7	26.7	12.8	47.2	13.3
Chestnut.....	1,803.4	.....	.....	.....	.....	.....	.....

Table 18. --Volume in cords, by tree species and type of material, 1940 -- Continued

SOUTHERN PIEDMONT

Tree species	All types of material		All sound material	Saw-timber trees		Sound trees under sawlog size	Cull trees
				Sawlog material	Upper stems		
	M cords	Percent	M cords	M cords	M cords	M cords	M cords
Softwoods:							
Loblolly pine...	966.7	2.2	955.4	524.4	123.5	307.5	11.3
Shortleaf pine..	9,788.2	22.5	9,603.7	4,255.1	1,206.5	4,142.1	184.5
Virginia pine...	4,933.6	11.3	4,409.2	1,539.8	492.4	2,377.0	524.4
Other softwoods.	353.0	0.8	330.9	134.8	25.7	170.4	22.1
All softwoods.	16,041.5	36.8	15,299.2	6,454.1	1,848.1	6,997.0	742.3
Hardwoods:							
Northern red oak	1,169.0	2.7	1,087.5	467.2	296.1	324.2	81.5
Other red oaks..	4,385.2	10.1	3,990.8	1,111.8	600.6	2,278.4	394.4
White oak.....	4,494.7	10.3	4,149.2	1,193.1	683.2	2,272.9	345.5
Chestnut oak....	1,993.3	4.6	1,642.0	430.6	221.1	990.3	351.3
Other white oaks	819.1	1.9	674.5	158.2	81.2	435.1	144.6
Red maple.....	1,384.3	3.2	910.9	198.6	113.2	599.1	473.4
Black tupelo....	902.4	2.1	705.5	139.6	75.1	490.8	196.9
Sweetgum.....	1,919.4	4.4	1,806.5	448.2	267.7	1,090.6	112.9
Yellowpoplar....	5,068.8	11.6	4,784.5	1,723.8	935.7	2,125.0	284.3
Beech.....	358.8	0.8	269.5	105.2	62.7	101.6	89.3
Hickory.....	1,576.0	3.6	1,481.6	454.3	244.0	783.3	94.4
Ash.....	604.6	1.4	487.8	107.6	57.4	322.8	116.8
Other hardwoods.	2,846.7	6.5	1,988.2	470.4	278.0	1,239.8	858.5
All hardwoods.	27,522.3	63.2	23,978.5	7,008.6	3,916.0	13,053.9	3,543.8
All species.....	43,563.8	.....	39,277.7	13,462.7	5,764.1	20,050.9	4,286.1
	.....		Percent	Percent	Percent	Percent	Percent
	.....	100.0	90.2	30.9	13.3	46.0	9.8
Chestnut.....	1,095.1	.....	.....	.....	.....	.....	.....

Table 19. -- Cubic-foot volume, by tree species and type of material, 1940

ENTIRE PIEDMONT

Tree species	All types of material		All sound material	Saw-timber trees		Sound trees under sawlog size	Cull trees
				Sawlog material	Upper stems		
	M cu. ft.	Percent	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Softwoods:							
Shortleaf and loblolly pines...	886,120	18.8	867,420	391,850	112,540	363,030	18,700
Virginia pine.....	677,860	14.4	603,630	214,850	59,480	329,300	74,230
Other softwoods...	46,260	1.0	43,740	19,990	3,740	20,010	2,520
All softwoods...	1,610,240	34.2	1,514,790	626,690	175,760	712,340	95,450
Hardwoods:							
Oak.....	1,609,380	34.2	1,421,910	438,920	212,770	770,220	187,470
Yellowpoplar.....	506,300	10.8	469,660	171,460	80,690	217,510	36,640
Hickory.....	183,360	3.9	168,510	51,270	23,200	94,040	14,850
Other hardwoods...	797,260	16.9	599,520	148,150	75,510	375,860	197,740
All hardwoods...	3,096,300	65.8	2,659,600	809,800	392,170	1,457,630	436,700
All species.....	4,706,540	.....	4,174,390	1,436,490	567,930	2,169,970	532,150
			Percent	Percent	Percent	Percent	Percent
	.....	100.0	88.7	30.5	12.1	46.1	11.3

NORTHERN PIEDMONT

			M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Softwoods:							
Shortleaf and loblolly pines...	177,300	9.5	171,340	68,960	21,260	81,120	5,960
Virginia pine.....	301,770	16.1	267,380	92,430	25,890	149,060	34,390
Other softwoods...	19,950	1.0	19,050	9,720	1,960	7,370	900
All softwoods...	499,020	26.6	457,770	171,110	49,110	237,550	41,250
Hardwoods:							
Oak.....	811,980	43.3	706,600	220,270	106,230	380,100	105,380
Yellowpoplar.....	195,060	10.4	176,540	62,300	29,350	84,890	18,520
Hickory.....	90,700	4.9	81,560	22,920	10,100	48,540	9,140
Other hardwoods...	276,900	14.8	199,660	47,980	24,470	127,210	77,240
All hardwoods...	1,374,640	73.4	1,164,360	353,470	170,150	640,740	210,280
All species.....	1,873,660	.....	1,622,130	524,580	219,260	878,290	251,530
			Percent	Percent	Percent	Percent	Percent
	.....	100.0	86.6	28.0	11.7	46.9	13.4

SOUTHERN PIEDMONT

			M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Softwoods:							
Shortleaf and loblolly pines...	708,820	25.0	696,080	322,890	91,280	281,910	12,740
Virginia pine.....	376,090	13.3	336,250	122,420	33,590	180,240	39,840
Other softwoods...	26,310	.9	24,690	10,270	1,780	12,640	1,620
All softwoods...	1,111,220	39.2	1,057,020	455,580	126,650	474,790	54,200
Hardwoods:							
Oak.....	797,400	28.1	715,310	218,650	106,540	390,120	82,090
Yellowpoplar.....	311,240	11.0	293,120	109,160	51,340	132,620	18,120
Hickory.....	92,660	3.3	86,950	28,350	13,100	45,500	5,710
Other hardwoods...	520,360	18.4	399,860	100,170	51,040	248,650	120,500
All hardwoods...	1,721,660	60.8	1,495,240	456,330	222,020	816,890	226,420
All species.....	2,832,880	.....	2,552,260	911,910	348,670	1,291,680	280,620
			Percent	Percent	Percent	Percent	Percent
	.....	100.0	90.1	32.2	12.3	45.6	9.9

Table 20. -- Growing stock in cords, by tree species and diameter class, 1940

ENTIRE PIEDMONT

Tree species	Diameter class (inches)				
	All classes	6 - 8	10-12	14-18	20 and larger
	Cords	Cords	Cords	Cords	Cords
Softwoods:					
Shortleaf and loblolly pines	13,198,600	5,745,800	5,279,000	1,900,900	272,900
Virginia pine	7,916,800	4,342,300	2,822,000	736,200	16,300
Other softwoods	587,300	269,600	142,900	101,200	73,600
All softwoods	21,702,700	10,357,700	8,243,900	2,738,300	362,800
	Percent	Percent	Percent	Percent	Percent
	100.0	47.7	38.0	12.6	1.7
	Cords	Cords	Cords	Cords	Cords
Hardwoods:					
Northern red oak	1,750,600	313,900	381,700	443,800	611,200
Other red oaks	5,920,600	1,817,400	2,116,000	1,233,500	753,700
White oaks	11,607,200	3,427,900	4,469,600	2,168,600	1,541,100
Red maple	1,198,300	441,700	458,100	218,500	80,000
Sweetgum	2,129,200	731,400	807,300	458,700	131,800
Yellowpoplar	6,193,100	1,624,700	1,861,000	1,791,400	916,000
Hickory	2,441,700	682,600	935,500	630,900	192,700
Other hardwoods	4,650,100	1,638,100	1,664,300	959,800	387,900
All hardwoods	35,890,800	10,677,700	12,693,500	7,905,200	4,614,400
	Percent	Percent	Percent	Percent	Percent
	100.0	29.7	35.4	22.0	12.9
	Cords	Cords	Cords	Cords	Cords
All species	57,593,500	21,035,400	20,937,400	10,643,500	4,977,200
	Percent	Percent	Percent	Percent	Percent
	100.0	36.5	36.4	18.5	8.6

Table 21. -- Growing stock per acre in cords, by forest type and condition, 1940

ENTIRE PIEDMONT

Forest type	All conditions	Saw-timber stands		Cordwood and reproduction stands
		Old growth	Second growth	
	Cords	Cords	Cords	Cords
Loblolly pine-hardwoods	12.59	.....	21.80	2.88
Shortleaf pine-hardwoods	11.98	24.64	17.66	4.82
Virginia pine-hardwoods	7.66	21.96	15.63	3.51
Bottom-land hardwoods	11.87	24.30	16.55	4.93
Cove hardwoods	14.57	22.41	18.03	7.36
Upland hardwoods	9.39	18.49	13.67	5.48
All types	9.88	20.06	15.60	4.76

NORTHERN PIEDMONT

Loblolly pine-hardwoods	4.34	.....	9.96	1.47
Shortleaf pine-hardwoods	11.43	28.62	17.65	5.13
Virginia pine-hardwoods	7.45	22.62	15.49	3.76
Bottom-land hardwoods	10.58	16.47	15.79	4.60
Cove hardwoods	13.11	21.06	17.02	6.62
Upland hardwoods	9.26	16.76	13.30	5.64
All types	9.24	17.50	14.69	4.95

SOUTHERN PIEDMONT

Loblolly pine-hardwoods	13.24	.....	22.40	3.04
Shortleaf pine-hardwoods	12.12	23.98	17.66	4.73
Virginia pine-hardwoods	7.84	20.62	15.74	3.28
Bottom-land hardwoods	12.89	33.08	17.06	5.25
Cove hardwoods	16.70	26.38	19.17	8.98
Upland hardwoods	9.51	22.14	14.00	5.33
All types	10.33	24.03	16.15	4.61

Table 22. -- Current annual net growth of saw timber, by tree species and forest condition, 1940

ENTIRE PIEDMONT

Tree species	All conditions		Saw-timber stands	Cordwood and reproduction stands
	M bd. ft	Percent	M bd. ft.	M bd. ft.
Softwoods:				
Shortleaf, loblolly pines	155,800	24.9	116,000	39,800
Virginia pine	130,600	20.9	72,300	58,300
Other softwoods	6,500	1.1	4,700	1,800
All softwoods	292,900	46.9	193,000	99,900
Hardwoods:				
Oak	158,500	25.4	120,600	37,900
Gums and yellowpoplar	123,400	19.7	95,200	28,200
Other hardwoods	49,700	8.0	38,700	11,000
All hardwoods	331,600	53.1	254,500	77,100
All species	624,500	100.0	447,500	177,000

NORTHERN PIEDMONT

Softwoods:				
Shortleaf, loblolly pines	27,100	11.7	17,600	9,500
Virginia pine	57,500	24.8	31,500	26,000
Other softwoods	2,900	1.3	2,100	800
All softwoods	87,500	37.8	51,200	36,300
Hardwoods:				
Oak	74,900	32.3	57,100	17,800
Gums and yellowpoplar	50,400	21.8	39,400	11,000
Other hardwoods	18,800	8.1	14,300	4,500
All hardwoods	144,100	62.2	110,800	33,300
All species	231,600	100.0	162,000	69,600

SOUTHERN PIEDMONT

Softwoods:				
Shortleaf, loblolly pines	128,700	32.8	98,400	30,300
Virginia pine	73,100	18.6	40,800	32,300
Other softwoods	3,600	.9	2,600	1,000
All softwoods	205,400	52.3	141,800	63,600
Hardwoods:				
Oak	83,600	21.3	63,500	20,100
Gums and yellowpoplar	73,000	18.6	55,800	17,200
Other hardwoods	30,900	7.8	24,400	6,500
All hardwoods	187,500	47.7	143,700	43,800
All species	392,900	100.0	285,500	107,400

Table 23. -- Current annual net growth of growing stock in cords, by tree species and forest condition, 1940

Tree species	All conditions		Saw-timber stands	Cordwood and reproduction stands
	Cords	Percent	Cords	Cords
ENTIRE PIEDMONT				
Softwoods:				
Shortleaf, loblolly pines	754,500	22.3	433,200	321,300
Virginia pine	750,800	22.2	292,300	458,500
Other softwoods	43,400	1.3	25,500	17,900
All softwoods	1,548,700	45.8	751,000	797,700
Hardwoods:				
Oak	825,300	24.4	473,700	351,600
Gums and yellowpoplar	598,800	17.7	368,200	230,600
Other hardwoods	410,500	12.1	229,700	180,800
All hardwoods	1,834,600	54.2	1,071,600	763,000
All species	3,383,300	100.0	1,822,600	1,560,700
NORTHERN PIEDMONT				
Softwoods:				
Shortleaf, loblolly pines	150,100	11.4	71,800	78,300
Virginia pine	336,700	25.5	119,200	217,500
Other softwoods	22,100	1.7	13,000	9,100
All softwoods	508,900	38.6	204,000	304,900
Hardwoods:				
Oak	413,400	31.3	223,200	190,200
Gums and yellowpoplar	231,900	17.6	141,300	90,600
Other hardwoods	164,900	12.5	80,000	84,900
All hardwoods	810,200	61.4	444,500	365,700
All species	1,319,100	100.0	648,500	670,600
SOUTHERN PIEDMONT				
Softwoods:				
Shortleaf, loblolly pines	604,400	29.3	361,400	243,000
Virginia pine	414,100	20.1	173,100	241,000
Other softwoods	21,300	1.0	12,500	8,800
All softwoods	1,039,800	50.4	547,000	492,800
Hardwoods:				
Oak	411,900	19.9	250,500	161,400
Gums and yellowpoplar	366,900	17.8	226,900	140,000
Other hardwoods	245,600	11.9	149,700	95,900
All hardwoods	1,024,400	49.6	627,100	397,300
All species	2,064,200	100.0	1,174,100	890,100

Table 24. -- Current annual net growth of cubic-foot growing stock, by tree species and forest condition, 1940

ENTIRE PIEDMONT

Tree species	All conditions		Saw-timber stands	Cordwood and reproduction stands
	M cu. ft.	Percent	M cu. ft.	M cu. ft.
Softwoods:				
Shortleaf, loblolly pines	51,210	22.4	30,760	20,450
Virginia pine	57,290	25.1	22,490	34,800
Other softwoods	3,230	1.4	1,890	1,340
All softwoods	111,730	48.9	55,140	56,590
Hardwoods:				
Oak	51,780	22.7	30,270	21,510
Gums and yellowpoplar	37,740	16.5	23,430	14,310
Other hardwoods	27,200	11.9	15,690	11,510
All hardwoods	116,720	51.1	69,390	47,330
All species	228,450	100.0	124,530	103,920

NORTHERN PIEDMONT

Softwoods:				
Shortleaf, loblolly pines	10,050	11.3	5,100	4,950
Virginia pine	25,640	28.8	9,140	16,500
Other softwoods	1,650	1.9	980	670
All softwoods	37,340	42.0	15,220	22,120
Hardwoods:				
Oak	25,740	29.0	14,170	11,570
Gums and yellowpoplar	14,580	16.4	8,950	5,630
Other hardwoods	11,250	12.6	5,880	5,370
All hardwoods	51,570	58.0	29,000	22,570
All species	88,910	100.0	44,220	44,690

SOUTHERN PIEDMONT

Softwoods:				
Shortleaf, loblolly pines	41,160	29.5	25,660	15,500
Virginia pine	31,650	22.7	13,350	18,300
Other softwoods	1,580	1.1	910	670
All softwoods	74,390	53.3	39,920	34,470
Hardwoods:				
Oak	26,040	18.7	16,100	9,940
Gums and yellowpoplar	23,160	16.6	14,480	8,680
Other hardwoods	15,950	11.4	9,810	6,140
All hardwoods	65,150	46.7	40,390	24,760
All species	139,540	100.0	80,310	59,230

Table 25. -- Current annual net growth per acre, by forest type and condition, 1940

ENTIRE PIEDMONT

Forest type	All conditions		Saw-timber stands		Cordwood and reproduction stands	
	Bd. ft.	Cord	Bd. ft.	Cord	Bd. ft.	Cord
Loblolly pine-hardwoods	150	0.69	262	0.98	31	0.38
Shortleaf pine-hardwoods	122	0.70	176	0.79	55	0.60
Virginia pine-hardwoods	102	0.63	182	0.79	60	0.56
Bottom-land hardwoods	130	0.67	183	0.79	59	0.52
Cove hardwoods	195	0.86	240	0.88	108	0.80
Upland hardwoods	96	0.51	145	0.58	55	0.44
All types	109	0.60	168	0.70	57	0.51

NORTHERN PIEDMONT

Loblolly pine-hardwoods	30	0.26	88	0.42	.....	0.18
Shortleaf pine-hardwoods	104	0.67	157	0.75	52	0.60
Virginia pine-hardwoods	92	0.64	177	0.76	54	0.58
Bottom-land hardwoods	118	0.63	169	0.76	59	0.48
Cove hardwoods	190	0.82	248	0.88	99	0.72
Upland hardwoods	91	0.50	141	0.56	49	0.45
All types	98	0.58	159	0.66	53	0.52

SOUTHERN PIEDMONT

Loblolly pine-hardwoods	159	0.72	271	1.01	35	0.40
Shortleaf pine-hardwoods	126	0.71	181	0.80	55	0.59
Virginia pine-hardwoods	110	0.63	186	0.80	66	0.53
Bottom-land hardwoods	140	0.70	192	0.80	58	0.55
Cove hardwoods	203	0.91	230	0.88	127	0.99
Upland hardwoods	101	0.51	148	0.60	60	0.44
All types	116	0.62	174	0.73	61	0.51

Table 26. -- Saw-timber commodity drain, by product and tree species, 1940

ENTIRE PIEDMONT

Product	All species	Short-leaf and loblolly pine	Virginia pine	Other soft-woods	Oak	Gums and yellow-poplar	Other hard-woods
	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.
Sawlogs.....	360,800	185,400	61,500	3,200	58,700	49,300	2,700
Veneer logs.....	9,500	.....	.....	.....	200	7,600	1,700
Cooperage bolts.	3,800	3,300	300	.....	100	100	.....
Hewn-tie bolts..	9,900	.....	.....	.....	9,900	.....	.....
Pulpwood.....	38,500	24,100	11,500	.....	.....	2,700	200
Fuel wood.....	37,200	14,000	12,700	.....	7,300	1,600	1,600
Fence posts.....	4,500	.....	100	2,600	1,400	.....	400
Poles and piles.	2,400	2,300	.....	.....	.....	.....	100
All others.....	1,900	400	.....	300	400	100	700
All products..	468,500	229,500	86,100	6,100	78,000	61,400	7,400

NORTHERN PIEDMONT

Sawlogs.....	89,100	29,900	23,000	600	23,300	11,200	1,100
Veneer logs.....	2,200	.....	.....	.....	.....	1,300	900
Cooperage bolts.	700	500	200	.....	.....	.....	.....
Hewn-tie bolts..	2,600	.....	.....	.....	2,600	.....	.....
Pulpwood.....	16,000	6,000	8,000	.....	.....	1,900	100
Fuel wood.....	7,000	700	2,400	.....	3,600	100	200
Fence posts.....	2,100	.....	.....	1,500	300	.....	300
Poles and piles.	100	100	.....	.....	.....	.....	.....
All others.....	400	.....	.....	100	100	100	100
All products..	120,200	37,200	33,600	2,200	29,900	14,600	2,700

SOUTHERN PIEDMONT

Sawlogs.....	271,700	155,500	38,500	2,600	35,400	38,100	1,600
Veneer logs.....	7,300	.....	.....	.....	200	6,300	800
Cooperage bolts.	3,100	2,800	100	.....	100	100	.....
Hewn-tie bolts..	7,300	.....	.....	.....	7,300	.....	.....
Pulpwood.....	22,500	18,100	3,500	.....	.....	800	100
Fuel wood.....	30,200	13,300	10,300	.....	3,700	1,500	1,400
Fence posts.....	2,400	.....	100	1,100	1,100	.....	100
Poles and piles.	2,300	2,200	.....	.....	.....	.....	100
All others.....	1,500	400	.....	200	300	.....	600
All products..	348,300	192,300	52,500	3,900	48,100	46,800	4,700

Table 27. -- Cubic-foot commodity drain, by product and tree species, 1940

ENTIRE PIEDMONT

Product	All species	Short-leaf and loblolly pine	Virginia pine	Other soft-woods	Oak	Gums and yellow-poplar	Other hard-woods
	M cu.ft.	M cu.ft.	M cu.ft.	M cu.ft.	M cu.ft.	M cu.ft.	M cu.ft.
Sawlogs	82,190	44,280	15,270	610	11,910	9,550	570
Veneer logs	2,370	.....	.....	.....	50	1,280	1,040
Cooperage bolts	1,100	900	110	.....	20	70	.....
Hewn-tie bolts	2,310	.....	.....	.....	2,310	.....	.....
Pulpwood	15,570	9,090	4,740	.....	20	1,630	90
Fuel wood	35,870	6,530	9,380	.....	12,930	3,080	3,950
Fence posts	3,520	10	20	1,340	600	.....	1,550
Poles and piles	610	590	.....	.....	.....	.....	20
All others	570	160	.....	100	100	10	200
All products	144,110	61,560	29,520	2,050	27,940	15,620	7,420

NORTHERN PIEDMONT

Sawlogs	21,220	7,670	6,120	120	5,040	2,030	240
Veneer logs	1,120	.....	.....	.....	.....	220	900
Cooperage bolts	290	170	90	.....	.....	30	.....
Hewn-tie bolts	600	.....	.....	.....	600	.....	.....
Pulpwood	7,050	2,530	3,280	.....	10	1,160	70
Fuel wood	7,970	470	1,590	.....	4,620	240	1,050
Fence posts	1,900	.....	.....	760	130	.....	1,010
Poles and piles	30	30	.....	.....	.....	.....	.....
All others	140	10	.....	50	30	10	40
All products	40,320	10,880	11,080	930	10,430	3,690	3,310

SOUTHERN PIEDMONT

Sawlogs	60,970	36,610	9,150	490	6,870	7,520	330
Veneer logs	1,250	.....	.....	.....	50	1,060	140
Cooperage bolts	810	730	20	.....	20	40	.....
Hewn-tie bolts	1,710	.....	.....	.....	1,710	.....	.....
Pulpwood	8,520	6,560	1,460	.....	10	470	20
Fuel wood	27,900	6,060	7,790	.....	8,310	2,840	2,900
Fence posts	1,620	10	20	580	470	.....	540
Poles and piles	580	560	.....	.....	.....	.....	20
All others	430	150	.....	50	70	.....	160
All products	103,790	50,680	18,440	1,120	17,510	11,930	4,110

Table 28. -- Net change in growing stock due to growth and drain, by forest condition and tree species and diameter class, 1940

ENTIRE PIEDMONT

Forest condition and tree species	Saw timber, of diameter (inches) --				All growing stock, of diameter (inches) --									
	All diameters	10-12	14-18	20 and larger	All diameters		6-8		10-12		14-18		20 and larger	
	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent
All conditions:														
Softwoods:														
Shortleaf, loblolly pines..	-73,700	-27,100	-28,900	-17,700	-10,350	-1.2	5,200	1.4	-7,930	-2.3	-4,410	-3.2	-3,210	-15.2
Virginia pine,other sftwds.	44,900	39,200	5,900	-200	28,950	4.6	15,850	4.7	11,120	5.0	1,930	3.0	50	0.8
All softwoods.....	-28,800	12,100	-23,000	-17,900	18,600	1.2	21,050	3.0	3,190	0.6	-2,480	-1.2	-3,160	-11.5
Hardwoods:														
Oak.....	80,500	.....	58,200	22,300	23,840	2.0	6,700	2.0	1,860	0.4	11,540	4.8	3,740	2.0
Gums and yellowpoplar.....	62,000	.....	43,000	19,000	22,120	3.9	8,380	5.2	4,290	2.2	6,700	4.4	2,750	4.0
Other hardwoods.....	42,300	.....	28,500	13,800	19,780	4.2	9,020	6.0	2,870	1.7	5,920	5.6	1,970	4.8
All hardwoods.....	184,800	.....	129,700	55,100	65,740	2.9	24,100	3.8	9,020	1.1	24,160	4.9	8,460	2.8
All species.....	156,000	12,100	106,700	37,200	84,340	2.3	45,150	3.4	12,210	0.9	21,680	3.1	5,300	1.6
Saw-timber stands:														
Softwoods:														
Shortleaf, loblolly pines..	-110,200	-55,600	-36,800	-17,800	-28,010	-3.9	-2,320	-1.0	-16,080	-5.0	-6,370	-4.8	-3,240	-15.6
Virginia pine,other sftwds.	-11,900	-14,900	3,200	-200	-2,630	-0.6	-880	-0.5	-2,880	-1.4	1,090	1.8	40	0.6
All softwoods.....	-122,100	-70,500	-33,600	-18,000	-30,640	-2.6	-3,200	-0.8	-18,960	-3.6	-5,280	-2.7	-3,200	-11.8
Hardwoods:														
Oak.....	44,400	.....	24,400	20,000	11,070	1.3	3,660	2.2	-660	-0.3	4,730	2.1	3,340	1.8
Gums and yellowpoplar.....	34,200	.....	16,500	17,700	10,320	2.3	3,660	3.7	1,350	1.0	2,760	1.9	2,550	3.7
Other hardwoods.....	31,500	.....	18,100	13,400	12,030	3.4	4,460	4.8	2,020	1.7	3,670	3.8	1,880	4.6
All hardwoods.....	110,100	.....	59,000	51,100	33,420	2.0	11,780	3.3	2,710	0.5	11,160	2.4	7,770	2.6
All species.....	-12,000	-70,500	25,400	33,100	2,780	0.1	8,580	1.1	-16,250	-1.5	5,880	0.9	4,570	1.4
Cordwood,reproduction stands:														
Softwoods:														
Shortleaf, loblolly pines..	36,500	28,500	7,900	100	17,660	11.6	7,520	6.2	8,150	31.4	1,960	59.6	30	8.3
Virginia pine,other sftwds.	56,800	54,100	2,700	.....	31,580	17.4	16,730	10.4	14,000	76.0	840	41.6	10	.....
All softwoods.....	93,300	82,600	10,600	100	49,240	14.8	24,250	8.6	22,150	49.9	2,800	52.7	40	11.1
Hardwoods:														
Oak.....	36,100	.....	33,800	2,300	12,770	3.6	3,040	1.9	2,520	1.4	6,810	40.0	400	61.5
Gums and yellowpoplar.....	27,800	.....	26,500	1,300	11,800	9.8	4,720	7.4	2,940	6.0	3,940	55.0	200	25.3
Other hardwoods.....	10,800	.....	10,400	400	7,750	6.9	4,560	8.0	850	1.8	2,250	30.2	90	12.5
All hardwoods.....	74,700	.....	70,700	4,000	32,320	5.5	12,320	4.4	6,310	2.3	13,000	41.1	690	31.9
All species.....	168,000	82,600	81,300	4,100	81,560	8.9	36,570	6.5	28,460	9.0	15,800	42.7	730	29.0

Table 28. -- Net change in growing stock due to growth and drain, by forest condition and tree species and diameter class, 1940 -- Continued

NORTHERN PIEDMONT

Forest condition and tree species	Saw timber, of diameter (inches) --				All growing stock, of diameter (inches) --									
	All diameters	10-12	14-18	20 and larger	All diameters		6-8		10-12		14-18		20 and larger	
	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent
All conditions:														
Softwoods:														
Shortleaf, loblolly pines..	-10,100	-1,100	-7,900	-1,100	-830	-0.5	1,360	1.7	-390	-0.6	-1,570	-6.7	-230	-7.4
Virginia pine,other sftwds.	24,600	18,500	4,700	1,400	15,280	5.6	8,850	6.0	4,740	5.1	1,370	5.0	320	11.2
All softwoods.....	14,500	17,400	-3,200	300	14,450	3.3	10,210	4.5	4,350	2.7	-200	-0.4	90	1.5
Hardwoods:														
Oak.....	45,000	.....	27,200	17,800	15,310	2.6	4,400	2.8	2,450	1.1	5,460	4.5	3,000	3.3
Gums and yellowpoplar.....	35,800	.....	23,800	12,000	10,890	5.6	3,480	6.4	2,250	3.3	3,570	7.1	1,590	7.0
Other hardwoods.....	16,100	.....	10,500	5,600	7,940	4.4	3,960	6.7	1,440	2.2	2,040	5.4	500	3.0
All hardwoods.....	96,900	.....	61,500	35,400	34,140	3.6	11,840	4.4	6,140	1.8	11,070	5.3	5,090	3.9
All species.....	111,400	17,400	58,300	35,700	48,590	3.5	22,050	4.4	10,490	2.1	10,870	4.2	5,180	3.8
Saw-timber stands:														
Softwoods:														
Shortleaf, loblolly pines..	-19,000	-7,800	-10,100	-1,100	-5,290	-4.0	-460	-1.0	-2,460	-4.1	-2,140	-9.5	-230	-7.4
Virginia pine,other sftwds.	-600	-5,500	3,500	1,400	-390	-0.2	-10	negl.	-1,580	-1.8	880	3.3	320	11.2
All softwoods.....	-19,600	-13,300	-6,600	300	-5,680	-1.8	-470	-0.4	-4,040	-2.7	-1,260	-2.6	90	1.5
Hardwoods:														
Oak.....	28,100	.....	11,700	16,400	6,780	1.7	1,610	2.2	90	0.1	2,320	2.0	2,760	3.1
Gums and yellowpoplar.....	24,900	.....	13,500	11,400	5,730	3.8	1,460	4.8	540	1.1	2,220	4.6	1,510	6.7
Other hardwoods.....	11,700	.....	6,200	5,500	4,050	3.1	1,690	5.0	790	1.7	1,110	3.1	460	2.9
All hardwoods.....	64,700	.....	31,400	33,300	16,560	2.4	4,760	3.4	1,420	0.7	5,650	2.8	4,730	3.7
All species.....	45,100	-13,300	24,800	33,600	10,880	1.1	4,290	1.7	-2,620	-0.7	4,390	1.8	4,820	3.6
Cordwood,reproduction stands:														
Softwoods:														
Shortleaf, loblolly pines..	8,900	6,700	2,200	.....	4,460	11.6	1,820	5.7	2,070	35.4	570	55.3	.....	....
Virginia pine,other sftwds.	25,200	24,000	1,200	.....	15,670	19.3	8,860	11.8	6,320	114.1	490	63.6	.....	....
All softwoods.....	34,100	30,700	3,400	.....	20,130	16.8	10,680	10.0	8,390	73.7	1,060	58.9	.....	....
Hardwoods:														
Oak.....	16,900	.....	15,500	1,400	8,530	4.6	2,790	3.3	2,360	2.5	3,140	41.9	240	80.0
Gums and yellowpoplar.....	10,900	.....	10,300	600	5,160	11.6	2,020	8.4	1,710	9.1	1,350	81.8	80	50.0
Other hardwoods.....	4,400	.....	4,300	100	3,890	8.0	2,270	9.1	650	3.1	930	39.2	40	11.1
All hardwoods.....	32,200	.....	30,100	2,100	17,580	6.3	7,080	5.4	4,720	3.5	5,420	47.1	360	43.9
All species.....	66,300	30,700	33,500	2,100	37,710	9.5	17,760	7.4	13,110	9.1	6,480	48.7	360	43.9

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Table 28. -- Net change in growing stock due to growth and drain, by forest condition and tree species and diameter class, 1940 -- Continued

SOUTHERN PIEDMONT

Forest condition and tree species	Saw timber, of diameter (inches) --				All growing stock, of diameter (inches) --									
	All diameters	10-12	14-18	20 and larger	All diameters		6-8		10-12		14-18		20 and larger	
	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent	M cu.ft.	Percent
All conditions:														
Softwoods:														
Shortleaf, loblolly pines..	-63,600	-26,000	-21,000	-16,600	-9,520	-1.4	3,840	1.4	-7,540	-2.7	-2,840	-2.5	-2,980	-16.6
Virginia pine,other sftwds.	20,300	20,700	1,200	-1,600	13,670	3.8	7,000	3.6	6,380	5.0	560	1.5	-270	-7.5
All softwoods.....	-43,300	-5,300	-19,800	-18,200	4,150	0.4	10,840	2.3	-1,160	-0.3	-2,280	-1.5	-3,250	-15.1
Hardwoods:														
Oak.....	35,500	.....	31,000	4,500	8,530	1.4	2,300	1.4	-590	-0.3	6,080	5.2	740	0.7
Gums and yellowpoplar.....	26,200	.....	19,200	7,000	11,230	3.0	4,900	4.6	2,040	1.7	3,130	3.1	1,160	2.5
Other hardwoods.....	26,200	.....	18,000	8,200	11,840	4.1	5,060	5.6	1,430	1.4	3,880	5.8	1,470	5.9
All hardwoods.....	87,900	.....	68,200	19,700	31,600	2.5	12,260	3.3	2,880	0.6	13,090	4.6	3,270	2.0
All species.....	44,600	-5,300	48,400	1,500	35,750	1.5	23,100	2.7	1,720	0.2	10,810	2.5	120	0.1
Saw-timber stands:														
Softwoods:														
Shortleaf, loblolly pines..	-91,200	-47,800	-26,700	-16,700	-22,720	-3.9	-1,860	-1.0	-13,620	-5.2	-4,230	-3.8	-3,010	-17.1
Virginia pine,other sftwds.	-11,300	-9,400	-300	-1,600	-2,240	-0.9	-870	-0.8	-1,300	-1.1	210	0.6	-280	-7.8
All softwoods.....	-102,500	-57,200	-27,000	-18,300	-24,960	-3.0	-2,730	-0.9	-14,920	-3.9	-4,020	-2.8	-3,290	-15.5
Hardwoods:														
Oak.....	16,300	.....	12,700	3,600	4,290	1.0	2,050	2.2	-750	-0.5	2,410	2.2	580	0.6
Gums and yellowpoplar.....	9,300	.....	3,000	6,300	4,590	1.5	2,200	3.3	810	0.9	540	0.6	1,040	2.3
Other hardwoods.....	19,800	.....	11,900	7,900	7,980	3.6	2,770	4.7	1,230	1.6	2,560	4.1	1,420	5.8
All hardwoods.....	45,400	.....	27,600	17,800	16,860	1.7	7,020	3.2	1,290	0.4	5,510	2.1	3,040	1.8
All species.....	-57,100	-57,200	600	-500	-8,100	-0.4	4,290	0.8	-13,630	-2.0	1,490	0.4	-250	-0.1
Cordwood,reproduction stands:														
Softwoods:														
Shortleaf, loblolly pines..	27,600	21,800	5,700	100	13,200	11.7	5,700	6.3	6,080	30.2	1,390	61.5	30	8.3
Virginia pine,other sftwds.	31,600	30,100	1,500	.....	15,910	15.9	7,870	9.2	7,680	59.6	350	28.0	10	.....
All softwoods.....	59,200	51,900	7,200	100	29,110	13.7	13,570	7.7	13,760	41.6	1,740	49.6	40	11.1
Hardwoods:														
Oak.....	19,200	.....	18,300	900	4,240	2.5	250	0.3	160	0.2	3,670	38.5	160	45.7
Gums and yellowpoplar.....	16,900	.....	16,200	700	6,640	8.8	2,700	6.8	1,230	4.1	2,590	46.9	120	19.0
Other hardwoods.....	6,400	.....	6,100	300	3,860	6.0	2,290	7.2	200	0.7	1,320	25.9	50	13.9
All hardwoods.....	42,500	.....	40,600	1,900	14,740	4.8	5,240	3.5	1,590	1.1	7,580	37.6	330	24.6
All species.....	101,700	51,900	47,800	2,000	43,850	8.4	18,810	5.8	15,350	8.9	9,320	39.4	370	21.8

Table 29. -- Production or consumption of timber by primary forest industries, 1940

ENTIRE PIEDMONT

Industry	Number of establishments	Unit of measure	Production or consumption, by species						
			All species	Shortleaf and loblolly pines	Virginia pine	Other softwoods	Oak	Gums and yellow-poplar	Other hardwoods
Lumber.....	1,196	Mil.b.f.	382.8	197.4	67.2	3.2	60.1	52.0	2.9
Veneer.....	3	Mil.b.f.	8.4	.....	.....	.....	0.3	7.2	0.9
Cooperage...	17	M cords	17.7	15.2	1.3	.....	0.4	0.8	.....
Hewn ties...	.....	M pieces	207	.....	.....	.....	207	.....	.....
Fuel wood...	.....	M cords	1,674.8	322.8	293.3	.....	713.8	159.3	185.6
Fence posts.	.....	M cords	57.1	0.1	0.3	18.4	10.3	.....	28.0
Poles, piles	.....	M pieces	22	22	.....	.....	.....	.....	.....
All others..	15	M cords	86.0	16.6	1.6	12.5	1.6	0.4	53.3

NORTHERN PIEDMONT

Lumber.....	322	Mil.b.f.	93.4	31.0	25.7	0.6	23.6	11.3	1.2
Veneer.....	.....	Mil.b.f.	.....	.....	.....	.....	.....	.....	.....
Cooperage...	5	M cords	3.9	2.6	1.1	.....	.....	0.2	.....
Hewn ties...	.....	M pieces	54	.....	.....	.....	54	.....	.....
Fuel wood...	.....	M cords	642.0	53.4	100.4	.....	379.0	30.2	79.0
Fence posts.	.....	M cords	31.5	.....	.....	10.2	2.3	.....	19.0
Poles, piles	.....	M pieces	1	1	.....	.....	.....	.....	.....
All others..	4	M cords	3.7	1.1	0.6	.....	0.4	0.2	1.4

SOUTHERN PIEDMONT

Lumber.....	874	Mil.b.f.	289.4	166.4	41.5	2.6	36.5	40.7	1.7
Veneer.....	3	Mil.b.f.	8.4	.....	.....	.....	0.3	7.2	0.9
Cooperage...	12	M cords	13.8	12.6	0.2	.....	0.4	0.6	.....
Hewn ties...	.....	M pieces	153	.....	.....	.....	153	.....	.....
Fuel wood...	.....	M cords	1,032.8	269.4	192.9	.....	334.8	129.1	106.6
Fence posts.	.....	M cords	25.6	0.1	0.3	8.2	8.0	.....	9.0
Poles, piles	.....	M pieces	21	21	.....	.....	.....	.....	.....
All others..	11	M cords	82.3	15.5	1.0	12.5	1.2	0.2	51.9

Literature Cited

(1) BALLAGH, JAMES C., ed.
1909. Southern economic history, 1607-1865 (Vol. V in "The South in the building of the nation"). 677 pp. Richmond, Va.

(2) BARRETT, LEONARD I., AND DOWNS, A. A.
1942. Hardwood invasion in pine forests of the piedmont plateau. Ms. submitted for publication.

(3) BELL, LANDON C.
1927. The old free state. Vol. I. 623 pp. Richmond, Va.

(4) BRADFORD, THOMAS G.
1838. Illustrated atlas, geographical, statistical, and historical, of the United States. 170 pp. Boston.

(5) BYRD, WILLIAM
1929. Histories of the dividing line betwixt Virginia and North Carolina. 341 pp. Raleigh, N. C. N. C. Hist. Comm.

(6) CAREY, H. D., AND LEA, I., pub.
1827. Historical, chronological, and geographical American atlas. 53 secs. Philadelphia.

(7) GRANTHAM, J. B.
1940. Wood-using industries of Virginia. Va. Polytec. Inst. Bul. XXXIV:1. Blacksburg, Va.

(8) GWATHMEY, JOHN H.
1937. Twelve Virginia counties. 469 pp. Richmond, Va.

(9) HEPTING, GEORGE H., et al.
1942. Second progress report on the little-leaf disease of southern pines. 25 pp., mimeographed.

(10) MORSE, JEDIDIAH
1795. American geography. 531 pp. Edinburgh.

(11) REYNOLDS, R. V., AND PIERSON, A. H.
1923. Lumber cut of the United States, 1870-1920. U. S. Dept. Agr. Bul. 1119. 63 pp.

(12) UNITED STATES BUREAU OF THE CENSUS
Census of agriculture (decennial), 1850-1940, incl.

(13) ——
Census of manufactures, 1822, 1860, 1880, 1890, 1909.

(14) ——
Census of population, 1790-1940, incl.

(15) _____
1937. Personnel and pay roll in industry and business, and farm personnel, by counties (Census of business, 1935). 161 pp. Washington.

(16) UNITED STATES WORKS PROGRESS ADMINISTRATION -- WRITERS' PROJECT
1940. Virginia -- a guide to the old dominion. 699 pp. New York.

(17) VIRGINIA FOREST SERVICE
1942. Unpublished forest-fire records.

(18) VIRGINIA STATE CHAMBER OF COMMERCE
1939. Directory of Virginia industries. The Commonwealth, Feb., 1939.

(19) VIRGINIA STATE PLANNING BOARD
1937. Report. Vol. IV-A: land use and agriculture, sects. 1-2. 137 pp., mimeographed.